VEGETABLE CROP PROTECTION GUIDE

2014–2015

Publication 838

Ministry of Agriculture
and Food

Ministry of Rural Affairs

Ontario

Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- federally registered
- classified by the Ministry of the Environment (MOE)

The information in this publication is general information only. The Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs (OMAF and MRA) do not offer any warranty or guarantee, nor do they assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

This publication lists a number of brand names of pesticides. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

The Pesticide Label

Consult each product label before you use a pesticide. The label provides specific information on how to use the product safely, hazards, restrictions on use, compatibility with other products, the effect of environmental conditions, etc.

The pesticide product label is a legal document. It is against the law to use the product in any other way.

Federal Registration of Pesticide Products

The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticide products for use in Canada based on following an evaluation of scientific data to ensure that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

1. **Full Registration**
   Pesticide registrations are normally granted for a period of five years, subject to renewal.

2. **Conditional Registration**
   Conditional registration may be granted for a specified, limited time period, where the registrant agrees to produce additional scientific or technical information, or the pesticide is used for emergency control of a serious pest outbreak.

Maximum Residue Limits

The PMRA has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Supplemental Labels

You MUST obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Emergency Use Registration**
- **Minor Use Label Expansion**

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAF and MRA or PMRA's Pest Management Information Service.

For more information on the federal registration status check the PMRA website at *www.healthcanada.gc.ca/pmra* or call 1-800-267-6315.

Regulation of Pesticides in Ontario

The MOE is responsible for regulating pesticide sale, use, transportation, storage and disposal in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09.

All Pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at *www.ontario.ca/e-laws* or by calling the ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOE, the classification of pesticide products before they can be sold or used in Ontario. Once approved by the MOE, classified products are posted on the MOE website: *www.ene.gov.on.ca*.

Certification and Licensing

Growers and their Assistants

For information about certification for growers and training for assistants check the Ontario Pesticide Education Program website: *www.opep.ca* or call 1-800-652-8573.

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at *www.ontariopesticide.com/index.cfm/home-page* or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at *www.hort-trades.com* or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at *www.oipma.ca*.

Cette publication est aussi disponible en français.

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Acknowledgements

The information contained in this publication is printed following review by the Vegetable Sub-Committee under the Ontario Pest Management Services Committee.

If you need technical or business information

contact the Agricultural Information Contact Centre at

1-877-424-1300

ag.info.omaf@ontario.ca

Looking for vegetable production information on the Internet?

Check the OMAF website at
www.ontario.ca/crops

This publication contains pest control products that have been registered as of October 31, 2013, on field vegetable crops in Ontario. Any supplements to this publication will be posted on the OMAF website at www.ontario.ca/crops.

This publication is a companion to OMAF Publication 839, *Ontario Field Vegetable Guide* (expected release date: 2015). This publication will contain more comprehensive information on disease and insect pest biology and management strategies, and other information related to the production of field vegetables in Ontario. Publication 363, *Vegetable Production Recommendations*, will remain available to growers, at a reduced price, providing vegetable production information until Publication 839 is available.

Cover images

Front cover photo: a medley of vegetables

Back cover small photos (left to right): asparagus rust, cutworm larvae on chickweed, bacterial blight of snap beans

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Introduction

Products Listed in This Book

Products listed in this book are registered for use on field vegetable crops and have been reviewed by the registrants and the Vegetable Sub-Committee under the Ontario Pest Management Services Committee.

Products are organized by pest for each vegetable crop. Consult each product label before you use a pest control product. Labels for registered pest control products are available at the Pest Management Regulatory Agency (PMRA) website at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php.

Crop Group Information

A crop group is a grouping of plant species based on botany and taxonomy (e.g., plant families), as well as on how the crops are produced. Crop groups are often further divided into smaller and more closely related subgroups. A pest control product may be registered on a subgroup, rather than the entire crop group. Crop groupings are used primarily to set maximum residue limits and establish a common pre-harvest interval (PHI) for a similar set of crops. It is important to remember that not all products have a crop group registration, and products registered on one crop are not necessarily registered on all members of its crop group. There are some crops that do not belong in a crop group. A complete list of all crops included in both original and revised crop groups can be found at the following link on Health Canada's website: www.hc-sc.gc.ca/cps-spc/pest/part/protect-proteger/food-nourriture/rccg-gcpcr-eng.php.

Levels of Control for Fungicides and Insecticides

The Efficacy Guidelines for Plant Protection Products in the *Pest Management Regulatory Agency Directive 2003–04* define levels of control as follows:

Fungicides

Control: The product, when applied in accordance with the label directions, consistently reduces disease incidence and severity to a commercially acceptable level.

Suppression: Consistent control at a level that is not optimal, but still of commercial benefit. Suppression is not used for products that show highly variable performance.

Insecticides

Control: The product, when applied in accordance with the label directions, consistently reduces pest numbers or pest damage to a commercially acceptable level.

Suppression: The product, when applied in accordance with the label directions, does not consistently reduce pest numbers or pest damage to a commercially acceptable level. Under such situations, the level of performance offered by the product must still have value in a pest management program.

Note: These guidelines are currently suggestions and are under review by the Pest Management Regulatory Agency. Current, approved Canadian labels may also include a statement "reduction in damage from" the target pest. This is an undefined level of control less than suppression, and this statement is still under review with the Pest Management Regulatory Agency.

1. Pest Management

Integrated pest management (IPM) is an approach to managing pests that uses all available strategies to reduce pest populations below an economic injury level. IPM does not advocate a continuous pesticide spray program to eradicate pests. Instead, it promotes the integration of cultural, mechanical, biological and chemical control strategies. Using these pest control strategies can minimize the adverse effects of pesticides on the environment and maintain economic returns.

An IPM program makes management decisions based on:

- pest identification, biology and behaviour
- beneficial organisms
- monitoring techniques
- use and timing of appropriate management tools
- resistance management strategies
- stage of crop growth
- recordkeeping

More detailed information on IPM for field vegetables can be found in OMAF publications such as:

- Publication 839, *Ontario Field Vegetable Guide* (expected release: 2015)
- Publication 363, *Vegetable Crop Production Guide 2010–11* (Publication 363, *Vegetable Production Recommendations*, will remain available to growers, at a reduced price, providing vegetable production information until Publication 839 is available. **Pest control guidelines contained in Publication 363 may be out of date.**)
- *Ontario CropIPM*, www.ontario.ca/cropIPM
- Publication 700, *Integrated Pest Management for Onions, Carrots and Lettuce in Ontario: A handbook for growers, scouts and consultants* (Video also available)
- Publication 12, *Sweet Corn Production Manual*

Current information is also available on the OMAF website at www.ontario.ca/crops. Additional information is supplied via newsletters, meetings, field monitoring, demonstrations and pest management workshops.

For more information on available IPM programs, contact OMAF's Agricultural Contact Centre at 1-877-424-1300, or the nearest OMAF Resource Centre.

For a list of available crop consultants providing monitoring services, contact OMAF's Agricultural Information Contact Centre at 1-877-424-1300, or the nearest OMAF Resource Centre.

Pest Control Measures

Cultural and Mechanical

Integrated pest management incorporates cultural and mechanical practices to prevent or delay the development of pest outbreaks. Management tools include, but are not limited to:

- site selection
- crop rotation
- resistant/tolerant cultivars
- certified seed
- treated seed
- sanitation
- elimination of alternative hosts
- inter-cropping
- water management (i.e., drainage, irrigation management)
- optimized plant and soil health
- barriers (i.e., row covers)
- encouraging natural enemies of crop pests

See *Pest Management for Organic Vegetable Growers*, on page 3, for more information on cultural, mechanical and biological controls.

Crop Rotation for Control of Diseases

Crop rotation can be an important practice for preventing some diseases caused by fungi, bacteria and nematodes. Rotation with non-susceptible crops for 3 years usually allows enough time for infected plant material in the soil to completely decompose. In the absence of susceptible plant material, these soil-borne pathogen organisms die off. For some soil-borne pathogens, such as phytophthora in peppers and cucurbit crops, a rotation longer than 3 years may be required.

Rotation only works when successive crops are not susceptible hosts. It is important to remember that plants in the same family (i.e., potatoes, tomatoes, peppers and eggplant) may all be susceptible to the same disease organisms. Do not rotate with plants in the same family.

Some diseases that are spread by wind or by insects may not be controlled by crop rotation. For example, some leaf blight organisms and powdery mildew fungi can blow into fields from neighbouring weeds and infested fields. However, crop rotation will reduce the level of many disease-causing organisms that remain in the soil or on crop residue left in a field.

Chemical Controls

Chemical controls include synthetic, inorganic and biological pesticides. They kill/inhibit development of target pests and thus limit subsequent pest populations. Plant defence activators (e.g., Actigard 50WG, Regalia Maxx) induce natural plant defences against crop pests, but do not directly impact the plant pathogen itself. Applications of plant defence activators to crops may "activate" the defence response of the plant, thus inhibiting infection.

Chemical controls are important tools for crop protection when used as part of an IPM program. Understand the pest's life cycle and apply chemicals at the stage when the pest is most vulnerable. Select the appropriate product for the target pests.

To control insects, monitor fields closely. Spray according to action thresholds or at critical stages of crop development.

To control disease, apply fungicides prior to disease infection and development. Use factors such as weather conditions, crop stage and (where available) disease prediction models to assist in fungicide spray timing.

Insect Control in Vegetable Crops During Bloom

Healthy pollinator populations are an essential element to many vegetable operations. Honeybees and native pollinators provide pollination services or may enter other fields looking for an alternate source of pollen or water. Some pest control products are toxic to bees and other pollinators through direct contact. Systemic insecticide products may also pose a high risk to bees and other insect pollinators. Bees can be exposed to product residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.

Many insecticide and miticide labels and some fungicide labels have specific precautions about applications during bloom. Some insecticide labels may include several precautionary statements. Label statements may include, but are not limited to:

- do not use on flowering crops or weeds
- do not apply to flowering crops or weeds if bees are visiting the treated area
- avoid spraying when bees are foraging (see *Precautions for Applying Insecticides*, page 3).

Please note that the information in this publication is general information only. Read each pest control product label for information on bee toxicity. See *Bee Poisoning*, on page 22, for information on preventing bee poisoning. Also, see the Pest Management Regulatory Agency's Best Management Practices *Protecting Pollinators during Pesticide Spraying*, available on the PMRA website (http://hc-sc.gc.ca/cps-spc/pest/index-eng.php) for more information.

Precautions for Applying Insecticides

This is general information only. Read each pest control product label for specific precautions regarding bees and/or other pollinators.

Dust generated during planting of treated seed may be harmful to bees and other pollinators:

- Cruiser 5FS[1]
- Gaucho 480 FL
- Poncho 600FS[1]

Do not use during crop or weed flowering period:

- Closer
- Cygon 480
- Fulfill 50WG
- Lagon 480 E
- Lorsban 15G
- Lorsban 50W
- Lorsban 4E/Lorsban NT
- Movento 240SC[2]
- Nufos 4E
- Pyrifos 15G
- Pyrinex 480EC
- Warhawk 480 EC

Do not apply to flowering crops or weeds if bees are visiting the treated area:

- Actara 240SC[3]
- Actara 25WG[3]
- Admire 240F[3]
- Agri-Mek 1.9%-EC
- Alias 240SC
- Assail 70WP
- Clutch 50WDG
- Concept
- Delegate WG
- Diazinon 500E
- Diazinon 50WSP
- Entrust 80
- Entrust
- Exirel
- Grapple[2]
- Imidan 70-WP
- Lannate TNG
- Malathion 25W
- Malathion 85E
- Matador 120EC
- Oberon Flowable[2]
- Orthene 75% SP
- Rimon 10 EC
- Silencer 120 EC
- Success
- Thionex 50W WSP
- Thionex EC
- Voliam Xpress
- Vydate L

Avoid spraying when bees are foraging:

- Ambush 500EC
- Decis 5 EC
- Dibrom
- Perm-UP
- Pounce 384EC
- Ripcord 400EC
- Sevin XLR
- UP-Cyde 2.5 EC

[1] Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatment applications. Also includes Titan ST.

[2] Bee brood may be exposed to residues in or on pollen and nectar brought back to the hive by bees foraging on flowering crops and weeds.

[3] Bees may be exposed directly, through spray drift, or to residues on/in leaves, pollen and nectar in flowering crops and weeds.

Natural Enemies (Beneficials)

Natural enemies are beneficial organisms, including predatory insects, parasites, pathogens and nematodes, which help suppress crop pest populations. Many beneficials occur naturally in the environment; others may be introduced to field or greenhouse production. To learn more about natural enemies in field vegetable crops, see the Great Lakes Vegetable Working Group website at www.ncipmc.org/glvwg/projects/NatEnemies.html.

Beneficials will not completely eliminate damage by pests. However, once they are established, they can maintain pest populations at lower levels. They are also effective at controlling indirect pests such as aphids, leafhoppers and mites. Beneficials are less effective at keeping populations of direct pests (those attacking the harvested product) at levels acceptable for commercial production. One of the advantages of beneficial insects is that their activities can prevent or delay the development of pesticide resistance.

Where possible, select chemical control products that will not harm the beneficials. Toxicity information regarding beneficial insects is available on some pest control product labels. For general information on the potential side effects of pest control products on beneficial insects, see Biobest's *Side-Effects Manual* at www.biobest.be/neveneffecten/3/none/ and/or Koppert Biological Systems' Side Effects at http://side-effects.koppert.nl/#. The information is provided as a guideline only.

Pest Management for Organic Vegetable Growers

Several organic certification bodies serve Ontario farms and processors. Contact these organizations to get information on how to be certified. For more information on certification, as well as addresses and links to details of the organic regulations and standards, see the Infosheet *Organic Food and Farming Certification* at www.ontario.ca/organic.

Pest management in organic production involves the use of numerous control strategies aimed at preventing pest problems before they appear. In organic production, pest control products should be used as a last resort, only when other management practices have not been sufficient to prevent the pest from causing economic damage to the crop.

Cultural Controls

Cultural controls are practices that make the cropping environment less favourable to the development of pests, including:

- **Site selection** — Choose sites less favourable for pest development.
- **Crop rotation** — Plant non-related crops in successive years to minimize the chances of plant-specific pests building up in the soil.
- **Cover crops** — Consider planting cover crops. Cover crops provide numerous benefits, which may include adding organic matter, improving soil structure, and reducing pest populations, depending on the type of cover crop.
- **Resistant varieties** — When available, select varieties known to be resistant to the particular pests present in your area. Some plant varieties can be much more tolerant in their response to pests.
- **Crop health** — Keep the crop healthier to help plants resist and tolerate pests, including maintaining optimum nutrition, plant moisture levels, plant population densities and soil conditions.
- **Planting or harvest dates** — Time planting or harvest to avoid damage if you know the biology of the pest attacking your crop.
- **Sanitation** — Practise good sanitation, including removing material (e.g., weeds or plant debris) that allows pests to survive or be transported between plants or crop, planting only high-quality seeds or transplants known to be free of insects and diseases, and taking appropriate measures to avoid transferring pests between plants or fields on contaminated tools, farm equipment or clothing.
- **Crop diversity** — Maintain crop diversity by intercropping, farmscaping or other methods. Growing a wide variety of plants in a small location can impede the movement of flying insects or the spread of disease, as well as providing a habitat for beneficial insects.
- **Trap crops** — Grow plants that an insect pest prefers nearby to try minimizing damage to crops.

Mechanical Controls

Mechanical control methods are those that physically remove the pest or otherwise prevent it from injuring the crop. This can be effective but have a high cost. Select strategies suited to the crop situation and scale of production.

- **Physical removal** — Physically remove pests by hand, dislodge them with strong jets of water, prune diseased plant parts, use vacuums or other means.
- **Mulches** — Place covers (e.g., wood chips, fabrics, plastics, etc.) on the soil surface for weed control or, in some cases, to deflect certain insects.
- **Row covers or other barriers** — Use barriers around and over plants to help protect them from pest attack.

Biological Controls

Biological control involves using a pest's natural enemies ("beneficials") to help suppress it. These may be predatory insects, parasites, pathogens or nematodes.

- **Promote beneficial insects** — Promote and attract natural enemy populations by providing them with favourable habitat and avoiding pesticides that negatively affect them.
- **Consider augmentation** — Release natural enemies into a crop for biological control. This method has been very successful in greenhouses but may have less value in outdoor crops where it is difficult to contain introduced natural enemies.

While use of these strategies to prevent pest problems from occurring is a requirement for organic producers, they are also the basis for integrated pest management in any production system, organic or conventional. More information on these strategies can be found on the OMAF website at www.ontario.ca/crops and in the section *Natural Enemies (Beneficials)*, on page 3.

Organic and Biopesticide Pest Control Products

Organic pest control products are pesticides that are approved for use in organic production. For organic products, both the active ingredient and all additional ingredients must be derived from natural sources (typically biological or botanical).

All organic pest control products must be *both* registered by the PMRA on the pest and crop on which they are used and meet the requirements of the Canadian Organic Standards and any additional requirements of the local organic certification body. Products included in one of the organic lists mentioned in *Table 1–1. Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Diseases,* on page 6, and *Table 1–2. Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Insects and Mites,* on page 8, may be acceptable. However, growers should always confirm with their certification body that the product is acceptable in their particular situation.

Biopesticides are products derived from natural materials such as plant extracts, bacteria and minerals. It is important to note that the definition of a biopesticide varies between organizations and countries. In Canada, biopesticides are divided into two major classes, microbial and biochemical pesticides.

Microbial pesticides contain a beneficial microorganism, such as a bacterium, fungus, virus or protozoan, as the active ingredient. They are relatively specific to their target pest. Microbial pesticides registered for use in vegetables include *Bacillus subtilis* (e.g., Serenade Max) and the various subspecies and strains of *Bacillus thuringiensis* (e.g., Bioprotec).

Biochemical pesticides are naturally occurring substances and/or their synthetic analogues. A synthetic analogue is a manufactured molecule that resembles a naturally occurring substance. They generally control pests by different mechanisms than conventional pesticides or by making crops unsuitable for feeding. While many biopesticides are less toxic and pose a lower risk than conventional pesticides, some can be quite toxic.

While many biopesticides are used in organic production, it is important to be aware that not all biopesticides are organically acceptable and that not all organic products are biopesticides. In some cases, the active ingredient may be organic, but it may be formulated with other ingredients that are not acceptable for organic production (e.g., some formulations of the bacteria *Bacillus thuringiensis*). Similarly, there are organic pest control products that do not meet the definition of a biopesticide (e.g., copper is a mineral and not considered a biopesticide).

See Table 1–1, *Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Diseases,* on page 6, and Table 1–2, *Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Insects and Mites,* on page 8, for more information on organic and biopesticide products that may be used on vegetable crops.

Organic Products in Conventional Production

While organic and biopesticide products are used most widely by organic producers, they can be a useful tool for conventional growers as well. Possible advantages for conventional producers include:

- lower potential for pest resistance
- providing a rotational option to help manage resistance development in other conventional products
- shorter re-entry intervals
- shorter pre-harvest intervals
- potentially lower toxicity to non-target organisms

While organic products and biopesticides can be helpful additions to IPM programs, they may not provide the same high level of control as conventional pesticides. Biopesticides are often labelled for suppression or partial suppression of pests. To improve control, combine their use with the other pest control tactics mentioned in the previous section.

Using Organic and Biopesticide Products

Although many organic and biopesticide products are formulated, packaged and applied in a very similar fashion to conventional pesticides, the active ingredients are different. They have unique, specialized modes of action that make them more susceptible to numerous biological and environmental factors.

Some of the possible challenges associated with using these products are:

- more frequent applications needed to control pests
- slower acting than conventional pesticides
- may provide suppression but not control of the pest
- more expensive than conventional pesticides
- fewer pests controlled

Table 1–1. Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Diseases

This information does not replace that included in product labels. Always check the label before use. Products listed as potentially acceptable for organic are those included in either (1) the Canadian database of brand name inputs for organic production (www.organicinputs.ca), (2) the 2013 Atlantic Canadian Organic Regional Network (ACORN) directory of organic inputs (www.acornorganic.org) or (3) the Organic Materials Review Institute (OMRI) Canada (www.omri.org/omri-canada). **Organic growers must always check with their certifying bodies to verify the acceptability of any product listed below prior to using it.**

LEGEND:

O = products that may be acceptable for use by organic growers, as indicated by lists described above (always confirm status with certifying body prior to using product)

NL = product is currently not listed on lists described above

B = product is considered a biopesticide in Canada according to the definition outlined in the previous section. Note that not all organizations use the same definition for biopesticides.

Common Name	Trade Name(s)[1]	Potentially Organic/ Biopesticide	Crops Registered[2]	Notes
DISEASE CONTROLS				
Bacillus subtilis	Serenade Max	O, B	asparagus, beans, brassicas, celery, cucurbits, garlic, leeks, shallots, chives, leafy vegetables, lettuce, onions, potatoes, radish, rutabagas, tomatoes, peppers, eggplant, sweet potatoes	**Disease suppression only.** This beneficial bacterium colonizes plant parts and helps prevent plant pathogens from becoming established. Apply prior to the development of disease symptoms. Copper is toxic to *B. subtilis.* Do not use in rotation with copper fungicides.
citric and lactic acid	Tivano	NL, B	pumpkins, squash, tomatoes	**Disease suppression only.** The active ingredients are the fermentation products of a strain of the bacteria *Lactobacillus casei.* They cause plant pathogen cell membranes to tear from the cell wall due to water loss, thus killing the cell. Thorough coverage of all leaf surfaces is essential. Coverage can be improved with a non-ionic surfactant. Apply preventively or in rotation with other fungicides.
Coniothyrium minitans	Contans WG	O, B	fields to be planted to lettuce, snap beans, carrots, cabbage, tomato, celery	**Disease suppression only.** The spores of a naturally occurring soil fungus attack the white mould resting bodies (sclerotia). Apply Contans at least 3 months prior to the anticipated infection period to allow ample time for the sclerotia to be destroyed. Incorporation by rainfall, irrigation or shallow tillage is required.
copper products	Copper 53W, Copper Spray, Guardsman Copper Oxychloride	O	beans, table beets, broccoli, Brussels sprouts, cabbage, carrot, cauliflower, celery, cucurbits, eggplant, onions, peppers, potatoes, spinach, tomatoes	Copper works by destroying plant pathogen enzymes, which are required for cell function. Applications of these products leave a deposit of copper particles on the plant surface to form a chemical barrier that protects the plants from invasion. Copper is non-systemic and has no effect on pathogens that have already invaded plant tissue. Repeat applications will be required to protect new growth. Some pathogens, such as *Pseudomonas syringae* pv. *tomato* (bacterial speck of tomato), have shown resistance to copper products.
	Kocide 2000	NL		
Gliocladium catenulatum	PreStop	O, B	greenhouse transplants of basil, parsley, thyme and dill	Beneficial fungi compete with pathogens such as *Pythium, Rhizoctonia* and *Fusarium.* Apply as a preventive treatment at planting. Do not tank-mix with other pesticides or fertilizers.
hydrogen peroxide	StorOx	O, B	potatoes, sweet potatoes	This product produces oxidation reactions that destroy the proteins and enzymes of certain plant pathogens. It is used post-harvest as a spray or direct injection into the humidification water.

[1] Where multiple trade names exist, not all crops are necessarily registered on each product. Always consult the product label for specific crop recommendations.

[2] Lists vegetable crops included on product label. Not all pests are problems on these crops in Ontario. Products should be used only for pests listed on the label.

Table 1–1. Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Diseases

This information does not replace that included in product labels. Always check the label before use. Products listed as potentially acceptable for organic are those included in either (1) the Canadian database of brand name inputs for organic production (www.organicinputs.ca), (2) the 2013 Atlantic Canadian Organic Regional Network (ACORN) directory of organic inputs (www.acornorganic.org) or (3) the Organic Materials Review Institute (OMRI) Canada (www.omri.org/omri-canada). **Organic growers must always check with their certifying bodies to verify the acceptability of any product listed below prior to using it.**

LEGEND:
O = products that may be acceptable for use by organic growers, as indicated by lists described above (always confirm status with certifying body prior to using product)
NL = product is currently not listed on lists described above
B = product is considered a biopesticide in Canada according to the definition outlined in the previous section. Note that not all organizations use the same definition for biopesticides.

Common Name	Trade Name(s)[1]	Potentially Organic/ Biopesticide	Crops Registered[2]	Notes
potassium bicarbonate	Milstop Foliar fungicide	O, B	cucurbits, peppers, herbs	**Disease suppression only**, except control of powdery mildew on peppers. This contact fungicide kills certain types of fungi by pulling water from the spores and cell walls. It has little residual activity. Apply prior to the development of disease symptoms.
Pseudomonas syringae	Bio-Save 10 LP	NL, B	potatoes and sweet potatoes (post-harvest)	This naturally occurring bacterium is commonly present on the surface of produce. The bacterium enters wounds on roots where pathogen spores live, competes for nutrients and can outgrow the pathogen at storage temperatures. Thorough coverage is critical, as the bacterium must enter wounds to be effective.
Reynoutria sachalinensis extract	Regalia Maxx	O, B	cucurbits, tomatoes	**Disease suppression only.** The active ingredient is an extract of the giant knotweed plant that triggers the natural defence mechanisms of plants, inhibiting the development of certain plant pathogens. It provides suppression and should be applied preventively, when conditions are conducive to disease development.
Streptomyces lydicus	Actinovate	O, B	peppers and tomatoes (transplants and field)	**Powdery mildew suppression only.** Actinovate contains live bacteria and should not be used with bactericides, such as fixed copper. Begin applications when conditions favour disease development. Additional applications every 7–14 days will be required.
Trichoderma harzianum	RootShield	O, B	field lettuce, cucumbers, peas, peppers and tomatoes	**Disease suppression only.** Naturally occurring soil fungi protect the transplant's root zone and feed upon pathogenic fungi including *Pythium, Rhizoctonia* and *Fusarium*.

[1] Where multiple trade names exist, not all crops are necessarily registered on each product. Always consult the product label for specific crop recommendations.

[2] Lists vegetable crops included on product label. Not all pests are problems on these crops in Ontario. Products should be used only for pests listed on the label.

Table 1–2. Organic and Biopesticide Products Used on Vegetable Crops in Ontario — Insects and Mites

This information does not replace that included in product labels. Always check the label before use. Products listed as potentially acceptable for organic are those included in either (1) the Canadian database of brand name inputs for organic production (www.organicinputs.ca), (2) the 2013 Atlantic Canadian Organic Regional Network (ACORN) directory of organic inputs (www.acornorganic.org) or (3) the Organic Materials Review Institute (OMRI) Canada (www.omri.org/omri-canada). **Organic growers must always check with their certifying bodies to verify the acceptability of any product listed below prior to using it.**

LEGEND:

O = products that may be acceptable for use by organic growers, as indicated by lists described above (always confirm status with certifying body prior to using product)

NL = product is currently not listed on lists described above

B = product is considered a biopesticide in Canada according to the definition outlined in the previous section. Note that not all organizations use the same definition for biopesticides.

Common Name	Trade Name(s)[1]	Potentially Organic/ Biopesticide	Crops Registered[2]	Notes
INSECT/MITE CONTROLS				
Bacillus thuringiensis (Bt)	Bioprotec CAF, Dipel 2X	O, B	beans, brassicas, celery, herbs, lettuce, parsley, potatoes, Asian radish, spinach, sweet corn, tomatoes	Bt is a stomach toxin and must be ingested by the target insect. It is most effective when applied to smaller instar larvae. Thorough coverage of the feeding area is essential.
	Bioprotec 3P, Thuricide HPC	NL, B	brassicas, celery, lettuce, peppers, potatoes, spinach, tomatoes	
Beauveria bassiana	Botanigard ES, Botanigard 22 WP	B	pepper, tomato and herb transplants, any other vegetable produced from greenhouse transplants	Fungal spores penetrate and invade soft-bodied insects, including aphids, thrips and white flies. Do not apply with fungicides or other insecticides.
ferric phosphate	Sluggo Professional	O, B	all vegetables, beans, brassicas, peas, sweet corn, sweet potatoes	Consists of ferric phosphate, a compound commonly found in soils, formulated in a bait. It damages the digestive tissue of snails and slugs, causing them to stop feeding and die. Apply in the evening to damper areas likely to be infested with slugs or snails. Soil must be moist but without standing water.
kaolin clay	Surround WP	O, B	carrots, celery, cucurbits, lettuce, parsley, spinach, potatoes	This product leaves an insect-repelling white film on all plant parts. Re-application will be necessary following periods of heavy rain, overhead irrigation or rapid plant growth. Do not spray when bees are active in the crop.
mineral oil	Purespray Green Oil 13 E, Superior 70 Oil	O	rutabagas, potatoes (to control virus vectors)	Mineral oil is a highly refined petroleum product. It is effective only when all pests are covered by the deposited film. Oils may cause plant injury — follow labels carefully for precautions.
potassium salts of fatty acids	Opal Insecticidal Soap	O	herbs, all vegetables	Soaps work by coating the bodies of soft-bodied insects, smothering them and interfering with their cuticles. They must be sprayed directly onto the target insect and have no effect once the soap deposits have dried. Thorough coverage is essential. Apply when drying conditions are slow, and avoid use of hard water.
spinosad	Entrust 80	O, B	asparagus, beans, brassica crops, celery, eggplant, lettuce, endive, leafy greens, parsley, green onions, leeks, chives, peppers, potatoes, radishes, rhubarb, rutabagas, turnips, spinach, Swiss chard, sweet corn, tomatoes	Spinosad is derived from the fermentation of a soil bacterium. It kills susceptible insects by exciting their nervous systems, causing them to die of exhaustion within 1–2 days. Coverage is important. Most effective on small larvae and small plants. Do not use when bees are present.
	Entrust	NL, B		

[1] Where multiple trade names exist, not all crops are necessarily registered on each product. Always consult the product label for specific crop recommendations.

[2] Lists vegetable crops included on product label. Not all pests are problems on these crops in Ontario. Products should be used only for pests listed on the label.

Resistance Management

Resistance is the ability of a pest to survive exposure to a pesticide at a rate or concentration that previously controlled it. Resistance to a pesticide develops after repeated exposure to a specific chemical or chemical family. A few naturally occurring resistant individuals survive after each application, while the susceptible portion of the population is killed. These resistant survivors multiply and gradually replace the susceptible ones. Eventually the resistant population dominates, and the pesticide loses efficacy.

There are many potential causes for pest control failures. Before assuming a population is resistant to a product, consider the following factors, which may affect the effectiveness of pest control products:

- **Product selection** — Select the appropriate product that has activity and is labelled for the specific pest(s)/crop combination. Certain pest control products may work only under specific circumstances (i.e., pests to be controlled, weather and soil conditions, timing, etc.).
- **Water volume** — See *Water Volumes,* on page 13.
- **Rate** — Ensure that pest control products are applied at the rate(s) indicated on the label.
- **Calibration and coverage** — See *Coverage,* on page 13.
- **Timing** — Some pest control products may work on specific life stages of a pest.
- **Water pH** — Some pest control products have water pH requirements.
- **Time required for knockdown of pest** — Some pest control products have delayed effects.
- **Weather conditions** — See *Air Temperature and Relative Humidity, Rainfall,* and *Wind Speed, Temperature Inversions and Drift,* on page 14.

Resistance to pesticides can develop very quickly. Do not use the same chemical repeatedly unless it is used in rotation with a different chemical or used in combination with other chemicals having a different mode of action.

Many chemicals with the same active ingredients are marketed under different brand names. For example, the insecticide chlorpyrifos is marketed under the brand names Lorsban, Pyrifos, Nufos, Pyrinex and Warhawk.

Different chemicals may also have the same mode of action. For example, both Assail and Admire, although different active ingredients, have the same mode of action. Using Assail after Admire is equivalent to using Assail after Assail, since resistance to both chemicals develops at the same time, even though only one may have been used repeatedly.

Certain pests are more prone to develop resistance to pesticides than others. Pests with a short life cycle and many generations per growing season are more likely to develop resistance. Pests are more likely to develop resistance to pesticides that have a single mode or site of action than to those with multiple modes of action.

See *Table 1–3. Insecticide Groups Based on Sites of Action,* on page 10, and *Table 1–4. Fungicide Groups Based on Mode of Action,* on page 11, for a list of chemical families and their modes of action.

The pest control tables in Chapter 3, *Crop Protection,* starting on page 27, list the chemical group (Group Name (Group #)) for each pest control product. Over the course of the season, rotate between products from different chemical groups.

Table 1–3. Insecticide Groups Based on Sites of Action

The classification scheme listed below is adapted from the Insecticide Action Committee Mode of Action Classification (IRAC) 7.2 (April 2012).

Group #	**Primary Site of Action**	**Group Name**	**Product name(s)**[2]
1A[1]	acetylcholinesterase inhibitors	carbamates[1]	Lannate TNG, Sevin XLR, Vydate L
1B		organophosphates	Agrox B-2, Agrox CD, Cygon 480, DCT, Diazinon 50 WSP, Diazinon 500 E, Dibrom, Imidan 70-WP, Lagon 480 E, Lorsban 15G, Lorsban 4E, Lorsban 50W, Lorsban NT, Malathion 25W, Malathion 85E, Nufos 4E, Orthene 75 SP, Pyrifos 15G, Pyrinex 480 EC, Thimet 15-G, Warhawk 480 EC
2A	GABA-gated chloride channel antagonists	cyclodiene organochlorines	Thionex EC, Thionex 50W WSP
3A	sodium channel modulators	pyrethroids	Ambush 500EC, Concept, Decis 5 EC, Force 3.0G, Matador 120EC, Perm-UP, Pounce 384EC, Ripcord 400 EC, Silencer 120 EC, UP-Cyde 2.5 EC, Voliam Xpress
4A	nicotinic acetylcholine receptor agonists	neonicotinoids	Admire 240 F, Admire 240 SPT, Assail 70 WP, Actara 240 SC, Actara 25WG, Alias 240 SC, Clutch 50 WDG, Concept, Cruiser 5FS, Gaucho 480 FL, Grapple$_2$, Poncho 600 FS, Titan
4C		sulfoxaflor	Closer
5	nicotinic acetylcholine receptor allosteric activators	spinosyns	Delegate WG, Entrust, Entrust 80, Success
6	chloride channel activators	avermectins	Agri-mek 1.9% EC
8B	non-specific inhibitors	chloropicrin	Chloropicrin 100, Pic Plus
9B	selective homopteran feeding blockers	pymetrozine	Fulfill 50WG
9C		flonicamid	Beleaf 50SG
11A	microbial disruptors of insect midgut membranes	*Bacillus thuringiensis*	Bioprotec 3P, Bioprotec CAF, Dipel 2X DF, Thuricide HPC
15	inhibitors of chitin biosynthesis, type 0	benzoylureas	Rimon 10 EC
17	moulting disruptor, Dipteran	cyromazine	Citation 75WP, Governor 75WP
18	ecdysone receptor agonists	diacylhydrazines	Intrepid
20B	mitochondrial complex III electron transport inhibitors	acequinocyl	Kanemite 15 SC
23	inhibitors of acetyl CoA carboxylase	tetronic and tetramic acid derivatives	Movento 240 SC, Oberon Flowable
28	ryanodine receptor modulators	diamides	Coragen, Exirel, Verimark, Voliam Xpress
NC	not classified	not classified	BotaniGard 22WP, BotaniGard ES, Opal Insecticidal Soap, Safer's Trounce, Sluggo Professional, Surround WP
UN	compounds of unknown or uncertain mode of action	bifenazate	Acramite 50WS

[1] Although sharing the same primary target site, it is possible that not all members of a single major mode of action (MoA) class have been shown to be cross-resistant. However, for the purposes of this classification system, it should be assumed that cross-resistance exists between compounds in any one sub-group.

[2] Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Table 1–4. Fungicide Groups Based on Mode of Action

This classification scheme is based on the Fungicide Resistance Action Committee (FRAC) List, February 2013.

Group #	Mode of Action (Target Site)	Group Name	Product Name(s)[1]	Risk of Developing Resistance
1	mitosis and cell division (ß-tubulin assembly)	methyl-benzimidazole carbamates	DCT, Senator 70WP, Senator PSPT	high
2	signal transduction (MAP/Histidine-kinase)	dicarboximides	Rovral	medium to high
3	sterol synthesis in membranes (C14-demethylase)	DMI (demethylation inhibitors)	Bumper 418 EC, Caramba, Dividend XL RTA, Emesto Silver, Inspire, Maxim D, Mettle 125 ME, Mission 418 EC, Nova, Proline 480 SC, Quadris Top, Quash, Quilt, Stadium, Tilt 250E, Topas	medium
4	nucleic acids synthesis (RNA polymerase I)	phenylamides	Allegiance FL, Apron Maxx RFC, Apron XL LS, Dividend XL RTA, Maxim XL, Ridomil Gold 1G, Ridomil Gold 480SL, Ridomil Gold MZ 68WG	high
7	respiration (complex II: succinate-dehydrogenase)	SDHI (succinate dehydrogenase inhibitors)	Cantus WDG, Emesto Silver, Fontelis, Lance WDG, Luna Tranquility, Pristine WG, Pro-Gro, Vertisan, Vitaflo 280	medium to high
9	amino acids and protein synthesis (methionine biosynthesis)	anilino-pyrimidines	Luna Tranquility, Scala SC, Switch 62.5 WG	medium
11	respiration (complex III: cytochrome bc1)	QoI (quinone outside inhibitors)	Acapela, Cabrio EG, Cabrio Plus, Dynasty 100FS, Flint, Headline EC, Pristine WG, Quadris Flowable, Quadris Top, Quilt, Reason 500SC, Stadium, Tanos 50 DF	high
12	signal transduction (MAP/Histidine-kinase)	phenylpyrroles	Apron Maxx RFC, Maxim 480FS, Maxim D, Maxim Liquid PSP, Maxim MZ PSP, Maxim PSP, Maxim XL, Scholar 230SC, Stadium, Switch 62.5 WG	low to medium
13	signal transduction	aza-naphthalenes	Quintec	medium
14	lipid synthesis and membrane integrity (lipid peroxidation (proposed))	aromatic hydrocarbons	Botran 75W	low to medium
17	sterol biosynthesis in membranes (3-keto reductase, C4-demethylation)	hydroxyanilides	Decree 50 WDG	low to medium
21	respiration (complex III: cytochrome bc1)	QiI (quinone inside inhibitors)	Ranman 400SC, Torrent 400SC	medium to high
22	mitosis and cell division (ß-tubulin assembly)	benzamides	Gavel 75DF	low to medium
24	amino acids and protein synthesis (protein synthesis)	hexopyranosyl antibiotic	Kasumin 2L	medium
27	unknown	cyanoacetamide oxime	Curzate 60 DF, Tanos 50 DF	low to medium
28	lipid synthesis and membrane integrity (cell membrane permeability (proposed))	carbamates	Tattoo C	low to medium
29	respiration (uncoupler of oxidative phosphorylation)	2,6-dinitroanilines	Allegro 500F	low
33	unknown	phosphonates	Aliette WDG, Confine Extra, Phostrol, Rampart	low
40	cell wall synthesis (cellulose synthase)	carboxylic acid amides	Acrobat 50 WP, Revus, Zampro	low to medium
43	mitosis and cell division (delocalization of spectrin-like proteins)	benzamides	Presidio	resistance not known
44	lipid synthesis and membrane integrity (microbial disrupters of pathogen cell membranes)	microbial	Cease Biological, Serenade ASO, Serenade Max	resistance not known
45	respiration	QxI (Quinone x Inhibitor)	Zampro	medium to high

[1] Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Table 1–4. Fungicide Groups Based on Mode of Action

This classification scheme is based on the Fungicide Resistance Action Committee (FRAC) List, February 2013.

Group #	Mode of Action (Target Site)	Group Name	Product Name(s)[1]	Risk of Developing Resistance
M1	multi-site contact	inorganic	Copper 53W, Copper Spray, Coppercide WP, Kocide 2000, Parasol Flowable, Parasol WG, Coppercide WP	low
M2	multi-site contact	inorganic	Microthiol Disperss, Microscopic Sulphur	low
M3	multi-site contact	dithiocarbamates	Cabrio Plus, Dithane Rainshield, Dithane F-45, Ferbam 76 WDG, Gavel 75DF, Granuflo-T, Manzate Pro-Stick, Maxim MZ PSP, Penncozeb 75DF Raincoat, Polyram DF, Pro-Gro, PSPT 16%, Ridomil Gold MZ 68WG, Solan MZ, Thiram 75 WP, Tuberseal, Vitaflo 280	low
M4	multi-site contact	phthalimides	Agrox B-2, Agrox CD, DCT, Folpan 80 WDG, Maestro 80DF, Supra Captan 80 WDG	low
M5	multi-site contact	chloronitriles	Bravo 500, Echo 720, Echo 90DF, Tattoo C	low
P1	host plant defence induction (salicylic acid pathway)	benzo-thiadiazole	Actigard 50WG	resistance not known
P5	host plant defence induction	plant extract	Regalia Maxx	resistance not known
NC	not classified (unknown)	not classified	Actinovate SP, Bio-Save 10 LP, Contans WG, DADS, MilStop, Prestop, Rootshield Granules, Rootshield HC, Storox, Tivano	resistance not known

[1] Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Steps to Delay the Development of Pesticide Resistance

- Rotate between products from different chemical groups. Avoid the repeated use of any one pesticide or group of pesticides.
- Follow the pesticide label. Many products make specific recommendations about the maximum number of sequential applications and the maximum number of total applications permitted in one season.
- When applying a pesticide, use the appropriate rate, timing, water volume, nozzle selection and water pH.
- Ensure the sprayer is well maintained and properly calibrated.
- Follow an IPM program that makes use of a variety of different pest management strategies, including cultural, mechanical, biological and chemical options.
- Spray insecticides only when necessary. Use established thresholds where available.
- Apply pest control products preventively before disease occurs. Wherever possible, follow disease prediction models. Applying fungicides in an attempt to eradicate a disease after it has become established is rarely effective and can increase the risk of selecting for resistant populations of the pathogen.
- When tank-mixing pest control products, ensure that each component belongs to a different chemical group with a different mode of action. Also ensure that they are compatible as a tank mix. Compatibility issues may result in problems in the tank or in reduced control or crop damage due to chemical interactions.
- If you experience a control failure after using a registered product, do not reapply the same pesticide.
- Keep accurate records of the type of product used during each application throughout the season.

Resistance can be costly to the grower. The development and registration of new products is expensive and time-consuming. Judicious use of pesticides will help reduce the development of resistant populations and conserve the effectiveness of existing products.

Spraying Vegetable Crops

Water Volumes

When the pesticide label does not prescribe a carrier volume, the spray operator must decide the appropriate volume. Ideally, it will be enough to suspend the product in solution and distribute spray droplets evenly over the target surface(s) but not so much as to cause excess spray to run off the plants. Most insecticides/fungicides are applied in 135–450 L/ha of water. Herbicide applications range from 55–350 L/ha. There are always exceptions. The spray operator must consider a few factors when determining an appropriate volume:

- **The mode-of-action of the product being applied.** For example, a contact product will require a higher droplet density than a locally systemic product, which has limited translocation in plant tissues.
- **The location of the target.** For example, if the target is a mobile insect found predominately on the upper-side of the leaf surface, it will be easier to spray and less carrier will be required. However, if the target is a disease that occurs deep in the plant canopy, more carrier volume will be required to penetrate and contact the pest.
- **The row spacing, size, density and stage of development of the crop.** The more plant canopy to be protected per hectare, the more carrier volume will be required to adequately cover all surfaces.

To confirm sufficient coverage, the sprayer operator requires some form of feedback. Visually inspecting foliar "wetness" and spray residue, or waiting to see if the spray successfully controlled the pest is not sufficient. By placing water-and-oil sensitive papers in key locations within the target canopy, the spray applicator can quantify coverage (see the section *Coverage*, on this page).

Coverage

Coverage can be defined as the number of discrete spray droplets per target area, combined with the total area covered. For example, a single large droplet impinging on a leaf would not be as effective as 100 smaller droplets evenly distributed over the leaf surface, even though they deliver the same amount of product. Good coverage on the upper, and often lower, leaf surface is an essential component of the performance of many fungicides and insecticides.

Water-and-oil sensitive paper is a tool that can be used to assess spray coverage in the field. *Table 1–5, Water-and-Oil Sensitive Paper — Recommended Droplet Density*, on this page, illustrates the paper manufacturer's recommended droplet density per square centimeter for insecticide, herbicide and fungicide applications.

Table 1–5. Water-and-Oil Sensitive Paper — Recommended Droplet Density

Number of droplets per cm^2	Application Type
20–30	insecticides
20–30	herbicides (pre-emergence)
30–40	contact herbicides (post-emergence)
50–70	fungicides

Nozzle Selection

All agricultural spray nozzle manufacturers classify the output rate and range of droplet sizes produced by each of their nozzles. This information appears in their catalogues as tables linking droplet size classification to nozzle size (output rate typically in U.S. gal/min.) and spray pressures (typically in lb/in.^{2}).

The American Society for Agricultural and Biological Engineers (ASABE) Standard S-572.1 droplet size classifications associate a colour and a code to flat fan nozzles to indicate their average droplet size (see *Table 1–6, ASABE ISO Standard Tip Colours and Symbols Denoting Volume Median Diameter for Flat Fan Nozzles*, on this page). Be aware that hollow cone nozzles are only just beginning to adopt these standards, and the manufacturer's catalogue should be consulted to confirm droplet sizes and rates.

Table 1–6. ASABE ISO Standard Tip Colours and Symbols Denoting Volume Median Diameter for Flat Fan Nozzles

Category	Symbol	Colour Code
Extra fine	XF	purple
Very fine	VF	red
Fine	F	orange
Medium	M	yellow
Coarse	C	blue
Very coarse	VC	green
Extra coarse	XC	white
Ultra coarse	UC	black

Most fungicides and insecticides require medium or medium-to-fine spray droplets. Smaller droplets are easily carried away on the wind and/or evaporate before hitting the target, resulting in pesticide drift and poor spray coverage. Poor spray coverage is a common cause of control failures. Coarse (or larger) droplets will greatly reduce the possibility of herbicide spray drift but should be used with higher carrier volumes to increase the number of droplets required for sufficient coverage of plant surfaces for insecticides or fungicides. Be aware that coarse droplets are prone to run-off and do not cover under-leaf surfaces without air-assist.

Hollow-cone nozzles produce more droplets with a finer size than solid-cone nozzles. Hollow- and solid-cone nozzles are particularly suited to the application of wettable powders, flowables and suspensions and may assist in penetrating dense crop canopies such as field tomato, particularly when combined with an air-assist curtain. However, excessive boom height and ambient wind will cause significant drift from these nozzles unless the sprayer is equipped with shrouds or an air-assist system to intercept drifting spray. Further, the pumps on many field sprayers may not produce sufficient pressure to properly operate cone nozzles, which typically run at 50 psi and greater.

Flat fan nozzles on approximately 50-cm centres provide uniform spray distribution across the whole boom. They are frequently used for herbicide applications but are becoming more common for fungicide and insecticide application as well. The newer, low-pressure air induction (aka Venturi) flat fan nozzles produce very coarse droplets that reduce drift significantly but, once again, may require higher carrier volumes to produce the critical droplet density required for coverage.

Air Temperature and Relative Humidity

Pesticides can cause phytotoxicity or burning of plant foliage or flowers if applied during very hot weather (temperatures above 25°C). In hot conditions, avoid midday applications, as plants will be more prone to injury. Spraying during hot conditions may also cause a large portion of the spray droplets to evaporate before they hit the target, reducing efficacy and increasing drift. For more information about weather conditions, see the OMAF Factsheet *How Weather Conditions Affect Spray Applications*.

During conditions of high relative humidity (greater than 80% relative humidity), the drying of the spray materials will be delayed. Slow and prolonged drying of pesticides can lead to phytotoxicity in some instances.

Synthetic pyrethroid insecticides (i.e., Ripcord, Decis, Pounce, Matador, etc.) break down quickly when air temperatures are above 25°C, reducing their effectiveness. If possible, apply these in the evening, when temperatures have dropped, or select a different product.

Rainfall

The decision to spray just prior to a rain or shortly after should be based on plant protection. This may be more critical when applying fungicides. Fungicides are most effective if the leaf is adequately covered prior to infection. Once they have dried, most fungicides can withstand about 2.5 cm of rainfall and still provide adequate protection.

Many pre-emergent herbicides are best applied before a rain. Moist soils allow for better distribution of the herbicide within the seed zone. Post-emergent applications are best applied after a rain or should be timed to allow adequate drying prior to rainfall.

Wind Speed, Temperature Inversions and Drift

When applying fungicides and insecticides, moderate air movement helps move the product in and around the crop. In addition, light winds will help in the drying process. Optimum air movement is 3–10 km/h.

Drift potential is affected by the interaction of boom height, droplet size and ambient wind speed. To avoid particle drift, do not spray when wind speeds are high or gusty. Spraying during periods of dead calm is not advised, because spray may remain suspended in the air until the wind changes and potentially be carried off-target.

Spraying fine droplets and/or a volatile agrichemical (e.g., 2,4-D, dicamba, etc.) when a period of weather stagnation or a strong temperature inversion is expected within 24 hr of completing the application can lead to vapour drift. This occurs when fine particles or volatilizing pesticide gets trapped and concentrated in the inversion layer, and move unpredictably over great distances within that layer.

For more information on preventing pesticide drift, see *Manage Drift*, on page 23, and the OMAF Factsheet *Pesticide Drift From Ground Applications*.

Soil Fumigation

Soil fumigants are used to control soil-borne pests of vegetables, including nematodes, weeds and plant pathogens. When using a fumigant, always follow the instructions on the label carefully regarding rates, soil/field conditions, application and sealing methods, plant back intervals and safety. Proper use of fumigants is important for safety and efficacy. Shank-injection of fumigants is preferable, as this application method reduces the volatilization of the fumigant gas, which greatly lessens the potential for the gas to drift off-target.

Prior to application, work the soil to a depth of 20–25 cm. The moisture content of the soil must be at a level that would permit good seed germination. Proper soil preparation is an important step for using fumigants, especially for metam potassium and metam sodium products.

Fumigation typically occurs either in the fall or in the spring — check product label for product-specific timings. With fall applications, work the soil several weeks before fumigation to ensure that the crop residue is well decomposed. Do not disturb the soil after sealing until the normal spring cultural operations are started. After spring fumigation, cultivate the soil thoroughly before planting to aerate and ensure that all traces of fumigant have dissipated. Ensure untreated soil is not mixed with treated soil during cultivation.

Note many fumigants require a 21-day plant-back interval or more to prevent damage to the crop. Soil temperatures affect the performance of fumigants and the length of time between application and planting. Consult each fumigant label for the appropriate soil temperature guidelines and how they impact plant-back intervals.

New Requirements (as of September 2014)

A written Fumigation Management Plan must be developed prior to the start of any soil fumigant application. Entry into the application block by any person (other than fumigant handlers, emergency personnel, and local, provincial or federal officials performing inspection, sampling or other similar official duties) is PROHIBITED during the application block period. Any person involved in the use of fumigants is considered a fumigant handler. All fumigant handlers must hold an appropriate pesticide applicator certificate or license recognized by the provincial/territorial pesticide regulatory agency where the pesticide application is to occur. Only fumigant handlers with an appropriate pesticide applicator certificate or license may be in the application block from the start of the application until the Application Block Period expires, and in the buffer zone during the Buffer Zone Period.

The application block period begins at the start of application and expires at least 5 days after the application is complete, depending on criteria during the application (i.e., tarped or non-tarped, etc.). The applicator must verbally warn workers of the application.

Fumigant Application signs must be posted on all entrances to the application block. Signs must be posted prior to the start of the application (but no sooner than 24 hr prior to application) and remain posted for the duration of the application block period. Signs must be removed within 3 days after the end of the application block period.

DO NOT apply when a temperature inversion is occurring, or is predicted to occur within 48 hr after application is complete, as fumigant vapours may drift.

DO NOT apply if light wind conditions (less than 3 km/h) are forecast to persist for more than 18 consecutive hours from the time the application starts until 48 hr after the application is complete.

Establish a buffer zone for fumigant applications. A buffer zone is an area established around the perimeter of each application block. See the label for the buffer zone area specific to each product. Before applying one of the fumigation products in *Table 1–7, Pre-Plant Management of Vegetable Pests Through Fumigation,* page 16, develop and implement a soil fumigation management plan. See product labels for details.

Caution

Carefully follow the manufacturer's directions for the use of soil fumigants. The information in this publication is general information only.

Table 1–7. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only. Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#)[1]	Crops	Application	Rate	Pests Controlled/Application Notes
chloropicrin	Chloropicrin 100 (25863)	tomatoes, peppers	broadcast or banded[2]	93 L/ha	Soil-borne pests (early-season control): • nematodes ◦ root knot nematode ◦ root lesion nematode (on root vegetables (CG1) only for Pic Plus; on root vegetables (CG1), tomatoes, peppers and potatoes for Chloropicrin 100) • diseases, certain species of ◦ *Phytophthora* spp. ◦ *Thielaviopsis* spp. ◦ *Fusarium* spp. ◦ *Pythium* spp. ◦ *Verticillium* spp. (Pic Plus only) **Application Notes** Prior to application, soil should be in condition for planting with sufficient moisture to support seed germination. Seal immediately after application by dragging a cultipacker immediately behind chisels, or wet down treated area to a depth of 2.5 cm. Leave soil undisturbed for 10–14 days. Aerate for at least 5 days after cultivation. Fumigation may temporarily raise the level of ammonia nitrogen and soluble salts in the soil. This is most likely to occur when heavy rates of fertilizer and fumigant are applied to soils that are either cold, wet, acid or high in organic matter. To avoid injury to plant roots, fertilize as indicated by soil tests taken after fumigation. **See label for details.** All areas broadcasted with a product containing chloropicrin must be covered with a plastic tarpaulin or Raven Vaporsafe 1 mil. film for a minimum of 5 days.
		potatoes	banded	55 L/ha	
		root vegetables (Crop group 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded[2]	93 L/ha	
	Pic Plus (28715)	tomatoes, peppers	broadcast or banded[2]	108 L/ha	
		potatoes	banded	64 L/ha	
		root vegetables (Crop group 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded[2]	108 L/ha	
dazomet	Basamid Granular (15032)	eggplant, lettuce, pepper, tomato	seedbeds	3.25–5 kg/ 100 m^2	• nematodes (unencysted only — will not control cyst nematode) • most germinating weed seeds • soil fungi **Application Notes** **Apply to well-cultivated, moist soil in seedbed condition only.** Soil should have a fine tilth and be free from clods and undecomposed roots or plant residues. Soil moisture level must be suitable for seed germination for a 5–7-day period prior to treatment. Water the soil as necessary to achieve and maintain this level. Incorporate and seal immediately after application. Leave soil undisturbed for 5–7 days after application when soil is warm or 2–4 weeks if soil is cool. Do not use if soil temperatures are below 6°C. Perform a safety germination test before planting, as described on label. See label for appropriate planting intervals and application details.

[1] The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

[2] Use the following formula to calculate the rate for banded application: rate for banded application = (product rate (L/ha) x 30)/row spacing (cm)

Table 1–7. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only. Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#)[1]	Crops	Application	Rate	Pests Controlled/Application Notes

metam potassium	Busan 1180 (25124)	vegetables	seedbed (injection)	430–553 L/ha	Soil-borne pests:
					• nematodes
					• weeds and germinating weed seeds (see label for list of weeds)
					• diseases
					  • *Rhizoctonia* spp.
					  • *Pythium* spp.
					  • *Phytophthora* spp.
					  • *Verticillium* spp.
					  • *Sclerotinia* spp.
					  • clubroot of crucifers
					Application Notes
					Inject into well-cultivated, moist soil only. Before applying, always cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten soil after cultivation to desired depth. Lightly cultivate immediately before application if soil has crusted. Seal immediately after incorporation. See the label for sprinkler recommendations and specifics on planting intervals.
					Planting may take place 21 days after treatment if soil is well-drained, light-textured and relatively dry and warm. May need to wait at least 30 days to plant if soils are heavy, high in organic matter or are wet and/or cold. Wait at least 60 days after application of 576 L/ha. Make frequent shallow cultivations to aerate heavy clay or if cold and wet conditions persisted after application.

			field (injection)	231–576 L/ha	
metam sodium	Enfuse M 510 (29142)	agricultural	broadcast	0.78 L/30 m^2	Soil-borne pests: • nematodes • weeds • fungi **Application Notes** Before applying, cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten loosened soil. Lightly cultivate immediately before application. Apply evenly over the moist, cultivated soil. Wait 7 days after application, then rake soil to a depth of 8 cm. Rake again 7 days later to a depth of 5 cm. Planting may take place 21 days after treatment if soil is well-drained, light- to medium-textured and relatively dry and warm. May need to wait at least 30 days to plant if soils are wet and/or cold.

[1] The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

[2] Use the following formula to calculate the rate for banded application: rate for banded application = (product rate (L/ha) x 30)/row spacing (cm)

Table 1–7. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only. Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#)[1]	Crops	Application	Rate	Pests Controlled/Application Notes
metam sodium (cont'd)	Busan 1020 (19421)	vegetables	seedbed (injection)	700–900 L/ha	Soil-borne pests: • nematodes • germinating weed seeds (see label for list of weeds) • diseases: • *Rhizoctonia* spp. • *Pythium* spp. • *Fusarium* spp. (Vapam HL only) • *Phytophthora* spp. • *Verticillium* spp. • *Sclerotinia* spp. • clubroot of crucifers **Application Notes** **Inject into well-cultivated, moist soil only.** Before applying, always cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten soil after cultivation to desired depth with watering. Keep the soil moist with watering if necessary until time to treat. Lightly cultivate immediately before application if soil has crusted. Seal immediately after injection. See the label for post-application cultivation and sprinkler recommendations. Planting may take place 21 days after treatment if soil is well-drained, light-textured and relatively dry and warm. If soils are heavy or especially high in organic matter or remain wet and/or cold following application, observe a minimum interval of 30 days after application. If in doubt, transplant a seeding plant and examine for injury before planting crop. On heavy and wet soils, light surface cultivation to break up crusting and promote drying of the soil should be done 5–7 days after application. This cultivation may be repeated as necessary. To avoid re-infesting treated soils, cultural practices should be such that untreated soils are not mixed with treated soils.
			field (injection)	375–935 L/ha	
	Busan 1236 (25103)	vegetables	seedbed (injection)	511–657 L/ha	
			field (injection)	274–683 L/ha	
	Vapam HL (29128)	vegetables	seedbed (injection)	410–670 L/ha	
			field (injection)	279–696 L/ha	

[1] The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

[2] Use the following formula to calculate the rate for banded application: rate for banded application = (product rate (L/ha) x 30)/row spacing (cm)

2. Using Pesticides in Ontario

The information in this chapter is updated regularly. For up-to-date information, visit www.ontario.ca/usingpesticides. Some of the information in this generic chapter may not apply to all crops.

Read the label before use.

Product labels may change.

Review the *Grower Pesticide Safety Course Manual.*

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) and be classified under the provincial *Pesticides Act*. The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticides for use in Canada following an evaluation of scientific data to ensure that the product has merit and value. It also ensures that any human health and environmental risks associated with its proposed uses are acceptable.

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when the pesticide is used according to the label. Outcomes of a re-evaluation can be:

- no change to the registration
- amendments to the label (e.g., changes to personal protective equipment requirements, restricted entry intervals, buffer zones)
- modifications to existing Maximum Residue Limits (MRLs)
- elimination or phasing-out of certain uses or formulations
- removal of the registration

The pesticide label is a legal document. It prescribes how the pesticide can be legally used. Labels for all registered pesticides are under "Search Pesticide Labels" on the PMRA website at www.healthcanada.gc.ca/pmra. Ensure you have the most current label and are aware of any re-evaluation decisions.

Regulation of Pesticides in Ontario

The Ministry of the Environment (MOE) is responsible for regulating the sale, use, transportation, storage and disposal of pesticides in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09. All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at www.ontario.ca/e-laws or by calling ServiceOntario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

Before a federally registered pesticide can be sold or used in Ontario, it must be classified under the provincial *Pesticides Act*. The Ontario pesticide classification system consists of 11 classes. Ontario's Pesticides Advisory Committee (OPAC) is responsible for assessing new pesticide products and recommending to the MOE the classification of these products. Pesticide products are classified on the basis of their toxicity, environmental and health hazard, persistence of the active ingredient or its metabolites, concentration, usage, federal class designation (e.g., domestic, commercial, restricted) and registration status. The provincial classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Once approved by the MOE, classified products are posted on the MOE website at www.ontario.ca/pesticides.

Certification and Licensing

Growers and Their Assistants

Growers must be certified through the Grower Pesticide Safety Course in order to buy and use Class 2 and 3 pesticides on their farms. They do not require this certification to use Class 4, 5, 6 or 7 pesticides. For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com/index.cfm/home-page or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council website at www.hort-trades.com or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Exception for Tree Care Specialists

For more information about requirements in the *Pesticides Act* and Regulation 63/09 for the exception regarding the use of pesticides to maintain the health of trees, see the Ministry of the Environment's website (www.ontario.ca/pesticideban). Click on "Industries and Institutions" and see the factsheet *Tree Care Specialists.*

For more information about pesticide regulations, certification and licensing, see:

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: www.healthcanada.gc.ca/pmra
- PMRA Pest Management Information Service: 1-800-267-6315 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment (MOE) website: www.ontario.ca/pesticides
- Regional MOE Pesticides Specialist (See *Appendix B. Ontario Ministry of Environment — Regional Contact Information,* on page 266.)
- Ministry of Agriculture and Food (OMAF) website: www.ontario.ca/omaf
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com/index.cfm/home-page
- Pesticide Industry Council website at www.hort-trades.com
- Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only properly calibrated sprayer equipment. Choose less toxic and less volatile alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. The label provides important information, such as:

- directions for use (e.g., rates of application, crops/sites it can be used on, target pests, crop rotation restrictions, total number of applications, droplet size/nozzle type, application equipment, timing, appropriate weather conditions)
- required personal protective equipment (PPE)
- hazard symbols and warnings
- restricted entry intervals
- buffer zones
- precautionary statements
- steps to be taken in case of an accident
- disposal

For more information on hazards, consult the Material Safety Data Sheet (MSDS) or contact the manufacturer.

For more information on pesticide application, see:

- OMAF Factsheet *Calibrating Airblast Sprayers*
- OMAF Factsheet *Adjusting, Maintaining and Cleaning Airblast Sprayers*
- OMAF Factsheet *How Weather Conditions Affect Spray Applications* (website only)
- OMAF Factsheet *Pesticide Drift From Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at www.opep.ca/index.cfm/learning-resources/videos/
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*
- OMAF Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Clean-up and Responsibilities*

Restricted Entry Intervals

The restricted entry interval, also referred to as re-entry interval (REI), is the period of time following a pesticide application during which workers must not enter the treatment area. This allows any pesticide residue and vapours to dissipate from the treatment location (e.g., field), preventing the possibility of inadvertent pesticide exposure.

The PMRA reviews each pesticide to determine whether the label should include a specific restricted entry interval. If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hours. For golf courses and residential turf applications, the spray solution must be dry before entry can occur. Some pesticides have labels that carry a warning about working in treated crops and provide specific PPE requirements. Follow the label recommendations.

Days to Harvest Intervals for Food Crops (Pre-harvest, Pre-grazing and Feeding Intervals)

These intervals state the minimum time that must pass between the last pesticide application and the harvesting of the crop or the grazing and cutting of the crop for livestock feed. If you harvest a crop before the pre-harvest interval (PHI) has passed, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

"Up to the day of harvest" means the same as 0 days PHI; however, the REI may be more restrictive (e.g., a 12-hour restricted entry interval) and must be observed for harvesting that occurs on the day of pesticide application.

To avoid exceeding the maximum residue limits, always follow the directions on the label.

Buffer Zones

Buffer zones, or no-spray areas, are areas left untreated to protect an adjacent sensitive area, such as sensitive terrestrial and aquatic habitats. Generally, a buffer zone is the downwind distance separating the point of direct pesticide application from the nearest boundary of a sensitive habitat.

Leave a suitable buffer zone between the treatment area and adjacent sensitive area. Buffer zones may vary depending on the method of application (e.g., aerial, field boom, air blast). Check the pesticide labels for buffer zone requirements.

Sensitive terrestrial habitats include hedgerows, grasslands, shelterbelts, windbreaks, forested areas and woodlots.

Sensitive freshwater habitats include lakes, rivers, streams, creeks, reservoirs, marshes, wetlands and ponds.

Health Canada's PMRA has an online spray drift calculator that allows applicators to modify the buffer zones specified on the product label based on weather conditions, the category of the spray equipment and the droplet size. For more information, see the Buffer Zone Calculator at www.hc-sc.gc.ca/cps-spc/pest/agri-commerce/drift-derive/calculator-calculatrice-eng.php.

Setback Distances for Water Bodies

It is an offence under the federal *Fisheries Act* to introduce into water any material that may be harmful to fish or fish habitat. To protect these waters, applicators must determine a suitable setback distance between the area to be protected and the area where pesticide treatments are planned (if the setback distance is not specified on the pesticide label). The protected area includes the water body as well as adjacent riparian (riverbank) areas that contribute to fish food and habitat.

Protect the Environment

Protect Water Sources

According to the British Crop Protection Council (BCPC), 40%–70% of surface water pesticide contamination comes from mixing and filling areas.

Where possible, load or mix pesticides on impermeable surfaces located safely away from watercourses or environmentally sensitive areas. Collect drainage and run-off, and dispose of it safely (*Your Guide to Using Pesticides,* BCPC 2007).

Clean your spray equipment away from wells, ponds, streams and ditches. Apply the diluted rinse water (usually at a ratio of 10:1) to the treatment area (crop), but do not exceed the pesticide rate recommended on the label.

Do not make a direct connection between any water supply (e.g., public supply, wells, watercourse or pond) and a spray tank. Use an anti-backflow device or intermediate system to prevent back-siphoning that could contaminate the water supply.

Immediately contain and clean up any spills to prevent contamination to water sources.

Check the pesticide label for specific instructions on protection of water sources.

For more information on protecting water sources, see:

- OMAF Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Clean-up and Responsibilities*
- OMAF Factsheet *Groundwater — An Important Rural Resource: Protecting the Quality of Groundwater Supplies*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*

Bee Poisoning

Honeybees, native bee species and other pollinating insects are important pollinators for many Ontario crops. Insecticides, some of which may negatively affect bees, require careful management to achieve both pollination and insect control. Growers and licensed commercial applicators can protect bees by following these suggestions:

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion. Under normal circumstances, spraying after 8 PM allows the spray to dry before the bees are exposed to it the next day. Early morning is the next best time, but spraying should be completed well before 7 AM. While honeybees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.
- Do not apply insecticides while fruit trees are in bloom. The *Bees Act* makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.
- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.
- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come in contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying it or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. See the *Field Crop News* blog at fieldcropnews.com for current information on ways to reduce dust movement.
- Beekeepers should remove honeybee colonies as soon as pollination is complete in the crop and before any insecticides are applied post bloom. If the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- If there is a risk of honeybee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.
- Always read the most current label for guidance.
- Before applying a pesticide or planting with insecticide-treated seed, advise local beekeepers so they can move colonies out of the danger area, if this is an option. Contact information for the local beekeepers' association in your area can be found on the Ontario Beekeepers' Association website at www.ontariobee.com/community/local-beekeepers-associations. Other ways to find

your local beekeepers are to contact the Provincial Apiarist at 1-888-466-2372, ext. 63595, or see www.ontario.ca/crops and click "Apiculture" and then "Bee Inspectors" for a list of provincial bee inspectors who know the local beekeepers.

Manage Drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product and may compromise crop protection and also may adversely affect nearby sensitive environmental areas, crops and wildlife. The following strategies can help reduce the risk of pesticide drift:

- Do not spray when wind speeds are high or gusty. These conditions increase the potential for spray and vapour drift. Check pesticide labels for allowable wind speeds for spraying applications. However, not all labels provide this specific information.
- Constantly monitor wind conditions during spraying using a good-quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as increasing water volume, minimizing nozzle-to-target distance, changing nozzle technology, changing fields because of surrounding influences or stopping spraying until conditions improve.
- Do not spray during periods of dead calm. Periods of dead calm may occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher, which can result in the spray droplets remaining aloft, like fog. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas. Off-target drift in calm conditions can occur hours after the spray event was completed.

Temperature inversions create problems for spray applicators because pesticide spray can:

- stay concentrated for long periods over the target
- move with the cool air over considerable distances when the breeze picks up
- move down slopes and concentrate in low-lying regions
- drift unpredictably as the inversion dissipates during the morning

Field air temperatures are often very different from local or regional forecasts, so the most reliable method of detecting inversion conditions is to measure temperatures at, and several metres above, the ground. Spray applicators can recognize a temperature inversion when:

- there is a big difference between the daytime and nighttime temperatures
- early evening and nighttime wind speeds are considerably less than during the day
- sounds seem to carry further
- odours seem more intense
- daytime cumulus clouds collapse toward evening
- overnight cloud cover is 25% or less
- mist, fog, dew or frost occur
- smoke or dust hangs in the air and/or moves laterally in a sheet

Temperature inversions start to form 3 hr prior to sunset, become stronger as the sun sets and continue until sunrise when the surface warms and air mixing begins. **If you suspect there's an inversion, then don't spray. Often, warnings for the risk of inversions are stated right on the product label.**

- Use the sprayer output specified on the pesticide label.
- Use a nozzle that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job. Nozzles that produce fine droplets are rarely, if ever, required.
- Where practical, use air induction/venturi nozzles, which significantly reduce drift compared to conventional nozzles.
- Check the height of the boom to the target or distance from airblast boom to the target. Minimize the distance as much as possible while still maintaining spray uniformity.
- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.
- Use spray plume protection where practical or available (hoods, shrouds, screens or air curtains).
- Use drift-reducing adjuvants in the spray tank as directed on the label. Mechanical or hydraulic agitations have been shown to reduce the effectiveness of certain drift-reducing adjuvants. Be aware that certain combinations of anti-drift adjuvants and air-induction/venturi nozzles have been shown to increase the incidence of fine droplets that will drift.
- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- OMAF Factsheet *Pesticide Drift From Ground Applications*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos *How to Manage Spray Drift* and *Spray Drift Reduction Through Air Induction*, available at www.opep.ca/index.cfm/learning-resources/videos/chapter-18-drift-of-pesticides/

Pesticide Disposal

Empty Pesticide Containers Up to 23 L

Never re-use empty containers.

The Ontario Empty Pesticide Container Recycling Program, an industry-led program, is available free of charge to growers and commercial applicators. Through this program, you can return triple-rinsed or pressure-rinsed plastic pesticide containers up to 23 L to container collection depots located throughout the province. Remove the cap and booklet from the pesticide container before recycling. To locate the closest container collection depot, visit www.cleanfarms.ca, call your local dealer, or contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Please note that, starting in 2013, this program now includes liquid fertilizer containers up to 23 L in size.

Empty Pesticide Containers Greater Than 23 L

Growers and commercial applicators can return pesticide containers that are greater than 23 L in size. Contact your local dealer for details on disposal of these containers, or contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Surplus Spray Mix

The best approach is to plan the spray job accurately to avoid creating a surplus.

When this is unavoidable, dispose of excess spray mix by spraying it on other crops that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that other crop.

If you cannot find another allowable crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or disposal of surplus spray mix.

Never re-spray the treated field with undiluted spray mix. Spraying an area twice at the same pesticide rate will double the labelled pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Surplus Pesticide Disposal

Be sure to safely dispose of pesticides that you do not need or cannot use. Options for proper disposal include:

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.
- CleanFARMS operates a free Obsolete Pesticide Collection Program throughout the province every 3 years. To locate the closest collection point and date, visit the CleanFARMS website (www.cleanfarms.ca), contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca or contact your local dealer for program details.
- Contact your municipality to see if any waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Table 2-1. Requirements for Pesticide Storage Facilities

	Pesticide Classes			
Storage requirements	**Class 2**	**Class 3**	**Class 4, 5 & 7**	**Class 6**
No contact with food or drink	**Yes**	**Yes**	**Yes**	**Yes**
Not an impairment to health and safety	**Yes**	**Yes**	**Yes**	No
Clean and orderly	**Yes**	**Yes**	**Yes**	No
Warning sign G posted[1]	**Yes**	**Yes**	**Yes**	No
Emergency telephone numbers posted[2]	**Yes**	**Yes**	**Yes**	No
Vented to outside	**Yes**	**Yes**	No	No
Limited access (locked)	**Yes**	**Yes**	No	No
No floor drain	**Yes**	**Yes**	No	No
Respiratory protection and protective clothing kept readily available	**Yes**	**Yes**	No	No
Area used primarily for pesticides	**Yes**	No	No	No

Note: Sufficient precautions are needed in your storage area to prevent the pesticide from entering the natural environment. Ensure your floor drain does not enter the natural environment.

[1] See the MOE website www.ontario.ca/environment-and-energy/notice-and-warning-signs for requirements for warning sign G. These signs can be purchased from your pesticide dealer/vendor.

[2] Emergency contact numbers must include telephone numbers for the local fire department, hospital and poison control centre. The number for the MOE Spills Action Centre (1-800-268-6060) should also be readily available.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 2–1, *Requirements for Pesticide Storage Facilities,* the storage requirements that must be followed are dependent on which classes of pesticides you store.

For more information about storing pesticides, see:

- OMAF Factsheet *Farm Pesticide Storage Facility*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual,* available at www.opep.ca. Select "Learning."

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment Spills Action Centre at 1-800-268-6060 (24 hours a day, 7 days a week) and your municipality.

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the spray solution to the environment is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area is also considered a spill.

Before you begin to clean up a spill of any nature, remember to protect yourself against pesticide exposure. Wear the proper protective clothing and personal protective equipment. If the spill occurs inside an enclosed area (e.g., a pesticide storage area or a vehicle during transport), ventilate the area first. Once you have protected yourself and removed other persons or animals from the spill site, take additional measures to stop the spill at the source and prevent it from spreading and/or contaminating watercourses. Specific precautions, emergency contact information and first aid procedures may be found on the label.

For minor spills, it may be possible to rectify the problem:

- **For a liquid spill** — Cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.
- **For a dust, granular or powder spill** — Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

For major spills, it is essential to stop the spill from spreading.

The clean-up guidelines above may not be appropriate for all spill situations. Once you have contained the spill, follow directions from the manufacturer and regulatory authorities on cleaning the contaminated area.

For information on preventing spills, see:

- OMAF Factsheet *Ways to Avoid Pesticide Spills*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual,* available at www.opep.ca. Select "Learning."

For pesticide poisonings and pesticide injuries, call:

Poison Information Centre:

1-800-268-9017

(TTY) 1-877-750-2233

For more information, see Emergency and First Aid Procedures for Pesticide Poisoning on the inside back cover.

3. Crop Protection

ASPARAGUS

In this section:

Table 3–1. Activity of Fungicides and Insecticides on Asparagus Diseases and Insects
Table 3–2. Asparagus Disease Control
Table 3–3. Asparagus Insect Control

This information is provided as a guideline only. See product labels for complete information.

Table 3–1. Activity of Fungicides and Insecticides on Asparagus Diseases and Insects

LEGEND: C = control
SC = some control of this pest may be expected when the product is used to control labelled pests
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Asparagus Beetle	Cutworms	Rust	Purple Spot (Stemphylium)
Fungicides						
myclobutanil	Nova	—	—	—	C	—
propiconazole	Mission 418 EC	—	—	—	C	—
	Topas	—	—	—	C	—
azoxystrobin	Quadris Flowable	—	—	—	—	C
trifloxystrobin	Flint	—	—	—	C	C
metiram	Polyram DF	—	—	—	C	—
chlorothalonil	Bravo 500	—	—	—	C	C
Insecticides						
carbaryl	Sevin XLR	—	C	C[1]	—	—
dimethoate	Lagon 480 E	C	—	—	—	—
	Cygon 480	C	—	—	—	—
malathion	Malathion 25W	—	C	—	—	—
cypermethrin	Ripcord 400 EC	—	C	—	—	—
	UP-Cyde 2.5 EC	—	C	—	—	—
deltamethrin	Decis 5 EC	—	C	—	—	—
lambda-cyhalothrin	Matador 120EC	C	SC	—	—	—
	Silencer 120 EC	C	SC	—	—	—
permethrin	Ambush 500EC	—	—	C	—	—
	Perm-UP	—	—	C	—	—
	Pounce 384EC	—	—	C	—	—
spinetoram	Delegate WG	—	S	—	—	—
spinosad	Entrust	—	C	—	—	—
	Success	—	C	—	—	—

[1] Late-season (climbing) cutworms only.

Table 3–2. Asparagus Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE SPOT (STEMPHYLIUM)					
QoI (group 11)	azoxystrobin	Quadris Flowable	0.45–1.12 L/ha (182–453 mL/acre)	180	Use high water volumes. Begin application prior to disease development.
	trifloxystrobin	Flint	210–280 g/ha (85–113 g/acre)	180	Begin application prior to disease development. Use higher rate and shorter interval when disease pressure is severe. 12-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	3.4 L/ha (1.4 L/acre)	190	Will also provide rust suppression under low disease pressure conditions. 48-hr re-entry interval.
RUST					
DMI (group 3)	myclobutanil	Nova	340 g/ha (138 g/acre)	—	**Post-harvest use only.**
	propiconazole	Mission 418 EC	150 mL/ha (61 mL/acre)	240	Apply at 14–21-day intervals.
		Topas	250 mL/ha (101 mL/acre)	240	Apply at 14–21-day intervals.
QoI (group 11)	trifloxystrobin	Flint	210–280 g/ha (85–113 g/acre)	180	Begin application prior to disease development. Use higher rate and shorter interval when disease pressure is severe. 12-hr re-entry interval.
dithiocarbamate (group M3)	metiram	Polyram DF	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	—	**Post-harvest use only.** Use high rate on full-grown fern. Apply at 7–10-day intervals.

Table 3–3. Asparagus Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
organophosphate (group 1B)	dimethoate	Cygon 480	2.3 L/ha (0.9 L/acre)	—	**Post-harvest only.**
		Lagon 480 E	2.3 L/ha (0.9 L/acre)	—	
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	180	**Post-harvest only.** 24-hr re-entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	180	
ASPARAGUS BEETLE					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–6.4 L/ha (1–2.6 L/acre)	2	Use high water volumes. Do not apply more than once every 3 days.
organophosphate (group 1B)	malathion	Malathion 25W	5.5 kg/ha (2.2 kg/acre)	1	No additional information.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	86 mL/ha (35 mL/acre)	1	Apply when beetles are first observed.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	1	Apply when beetles are first observed. 12-hr re-entry interval.
	deltamethrin	Decis 5 EC	200 mL/ha (81 mL/acre)	—	Apply after cutting only.
spinosyn (group 5)	spinetoram	Delegate WG	140–280 g/ha (57–113 g/acre)	60	**Suppression only. Post-harvest only.** Apply at egg-hatch to small larvae. Use higher rates for heavy populations or larger larvae. 12-hr re-entry interval.
	spinosad	Entrust	294 mL/ha (119 mL/acre)	60	**Post-harvest only.** Apply just after egg-hatch to small larvae. Re-entry permitted once spray deposit has dried.
		Success	145 mL/ha (59 mL/acre)	60	
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–6.4 L/ha (1–2.6 L/acre)	2	**Late-season (climbing) cutworms only.** Do not treat more than once every 3 days.
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	2	Use only the low rate during the cutting season. Use high rate on dry soils or large cutworms. Do not disturb the soil surface for 5 days after treatment. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	2	Use only the low rate during the cutting season. Use high rate on dry soils or large cutworms. Do not disturb the soil surface for 5 days after treatment. 12-hr re-entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	2	Use only the low rate during the cutting season. Use high rate on dry soils or large cutworms. Do not disturb the soil surface for 5 days after treatment. Re-entry permitted once spray deposit has dried.

BEANS

In this section:

Table 3-4. Snap and Lima Bean Seed Treatments
Table 3-5. Activity of Fungicides on Snap and Lima Bean Diseases
Table 3-6. Snap and Lima Bean Disease Control
Table 3-7. Activity of Insecticides on Snap and Lima Bean Insects
Table 3-8. Snap and Lima Bean Insect Control — Leafhoppers, Bean Beetles, Aphids
Table 3-9. Snap and Lima Bean Insect Control — European Corn Borers, Western Bean Cutworms, Cutworms, Slugs, Brown Marmorated Stink Bugs

This information has been provided as a guideline only. See product labels for complete information.

Table 3–4. Snap and Lima Bean Seed Treatments

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
— = not registered for control of this pest, or activity on this pest has not been documented.

		Insects			**Seedling Blights**					
Active Ingredient(s)	**Trade Name**	**Seedcorn Maggots**	**Wireworm**	**Potato Leafhopper**	**Anthracnose**	**Phytophthora**	**Pythium**	**Fusarium**	**Rhizoctonia**	**Notes**
Fungicide Only										
metalaxyl-M and S-isomer	Apron XL LS	—	—	—	—	C	C	—	—	**For use in seed-treatment plants only.** See the product label for rates.
metalaxyl	Allegiance FL	—	—	—	—	C	C	—	—	**For use by commercial seed treaters only.** See the product label for rates.
fludioxonil/ metalaxyl-M and S	Apron Maxx RFC	—	—	—	C	SC	C	C	C	**For use in commercial or on-farm seed-treatment equipment only.** Use 100 mL/100 kg of seed. See label for recropping restrictions.
carbathiin/thiram	Vitaflo	—	—	—	C	—	SC	SC	C	**Snap beans only.** For use in commercial seed-treaters. 260 mL/100 kg of seed. Do not store treated seed.
copper hydroxide	Kocide 2000	—	—	—	—	—	—	—	—	Suppression of seed-borne bacterial diseases (common blight, halo blight and bacterial brown spot). Use 113 g/100 kg of seed in 200 mL of water. May delay germination.
Trichoderma harzianum	RootShield HC	—	—	—	—	—	S	S	S	Seed box treatment. 60–125 g/50 kg of seed.
thiram	Thiram 75 WP	—	—	—	—	—	C	C	C	**Snap beans only.** Seed box treatment. Use 25–35 g/25 kg of seed.
Insecticide Only										
imidacloprid	Gaucho 480 FL[1]	—	—	C	—	—	—	—	—	**For use in commercial seed treaters only.** Use 130 mL/100 kg of seed. Gaucho-treated seed should not be carried over.
thiamethoxam	Cruiser 5 FS[2]	C	C	C	—	—	—	—	—	**For use in commercial seed treatment facilities with closed transfer and treatment equipment only.** See product label for rates. Request the high rate of Cruiser for wireworm control and early-season soybean aphids.
Fungicide + Insecticide										
diazinon/ captan	Agrox B-2	C	—	—	—	—	C	C	C	Seed box or slurry treatment. Use 80 g/25 kg of seed. Do not use on seed previously treated with an insecticide. Plant seeds within 1 month of treatment.
diazinon/ captan	Agrox CD	C	—	—	—	—	C	C	C	Seed box treatment. Use on seed previously treated with captan or thiram. Use 50 g/25 kg of seed. Do not use on seed previously treated with an insecticide.
thiamethoxam + metalaxyl-M and S-isomer/fludioxonil	Cruiser 5FS[2] + Apron Maxx RFC	C	C	C	C	SC	C	C	C	**Cruiser 5FS is for use in commercial seed treatment facilities with closed transfer and treatment equipment only.** See the product labels for rates. Request the high rate of Cruiser for wireworm control and early-season soybean aphids. See Apron Maxx RFC label for recropping restrictions.

[1] Dust generated during the planting of treated seed may be harmful to bees and other pollinators.

[2] Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–5. Activity of Fungicides on Snap and Lima Bean Diseases[1]

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Root Rots	Bacterial Blights	White Mold (Sclerotinia)	Anthracnose	Angular Leafspot	Rust	Phytophthora Blight
iprodione	Rovral	—	—	C	—	—	—	—
metalaxyl-M and S	Ridomil Gold 480SL	C	—	—	—	—	—	—
boscalid	Lance WDG	—	—	C	—	—	—	—
penthiopyrad	Fontelis	—	—	—	C	C	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	C	—	—	—	—
pyraclostrobin	Headline EC	—	—	—	SC	C	C	—
dicloran	Botran 75 W	—	—	C	—	—	—	—
cyazofamid	Ranman 400SC	—	—	—	—	—	—	C
	Torrent 400SC	—	—	—	—	—	—	C
fluazinam	Allegro 500F	—	—	C	—	—	—	—
Coniothyrium mintans	Contans WG	—	—	S	—	—	—	—
copper hydroxide	Coppercide WP	—	C	—	—	—	—	—
	Kocide 2000	—	C	—	—	—	—	—
	Parasol WG	—	C	—	—	—	—	—
copper sulphate	Copper 53W	—	C	—	—	—	—	—

[1] For seed decay and root rots, see *Table 3–4. Snap and Lima Bean Seed Treatments*, on page 31.

Table 3–6. Snap and Lima Bean Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BACTERIAL BLIGHT (HALO AND COMMON)					
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	1	Make first application when plants are 15 cm (6 in.) high. 48-hr re-entry interval.
		Kocide 2000	1.6–2.3 kg/ha (0.65–0.9 kg/acre)	1	
		Parasol WG	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	1	
	copper sulphate	Copper 53W	5.5 kg/ha (2.2 kg/acre)	1	
WHITE MOLD (SCLEROTINIA)					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg/ha (0.6 kg/acre)	15	**Snap beans only.** Spray at 50% bloom. Use a non-ionic adjuvant to improve performance. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Lance WDG	560–770 g/ha (227–312 g/acre) **gray mold control:** 420 g/ha (170 g/acre)	7	Spray at 20%–50% bloom with a second application 7 days later. See label for recropping restrictions. 12-hr re-entry interval.
anilino-pyrimidines (group 9)/ phenylpyrrole (group 12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Spray at 10%–20% bloom. Repeat after 7 days if the conditions remain favourable for disease development. Use the higher application rate under conditions of high disease pressure. See label for recropping restrictions. 12-hr re-entry interval.
aromatic hydrocarbon (group 14)	dicloran	Botran 75W	3.25 kg/ha (1.3 kg/acre)	2	**Snap beans only.** Also controls gray mold. Spray at first bloom. Do not feed treated foliage to livestock. 12-hr re-entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	0.6–1 L/ha (242–400 mL/acre)	14	Spray at 10% bloom with a second spray 7 days later. Use the higher application rate under conditions of high disease pressure. 24-hr re-entry interval.
microbial (group 44)	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Suppression only. Snap beans only.** Apply to soil prior to or at planting. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre).
ANGULAR LEAFSPOT, RUST					
SDHI (group 7)	penthiopyrad	Fontelis	1–2.25 L/ha (0.4–0.9 L/acre)	0	Also controls anthracnose. See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	Lima beans (rust control). See label for recropping restrictions. 12-hr re-entry interval.
			400 mL/ha (162 mL/acre)	7	Snap beans (angular leaf spot control). See label for recropping restrictions. 12-hr re-entry interval.
PYTHIUM DAMPING-OFF					
phenylamide (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480SL	2.3 mL/100 m of row[1] (0.7 mL/100 ft of row)	—	**Snap beans only.** Banded soil application at planting. 12-hr re-entry interval.
PHYTOPTHORA BLIGHT					
QiI (group 21)	cyazofamid	Ranman 400SC	200 mL/ha (81 mL/acre)	0	**Suppression only.** Use with a surfactant as described on label. See label for recropping restrictions. 12-hr re-entry interval.
		Torrent 400SC	200 mL/ha (81 mL/acre)		

[1] 76-cm row spacing, with a 20-cm spray band requires 300 mL/ha (121 mL/acre) of Ridomil Gold 480SL.

Table 3–7. Activity of Insecticides on Snap and Lima Bean Insects[1]

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leafhoppers	Slugs	Cutworms	Brown Marmorated Stink Bug	European Corn Borer	Western Bean Cutworm	Mexican Bean Beetles	Bean Leaf Beetle	Spider Mites
carbaryl	Sevin XLR	—	C	—	—	—	—	—	C	—	—
methomyl	Lannate TNG	—	—	—	—	S	C	—	—	—	—
dimethoate	Cygon 480	C	C	—	—	—	—	—	C	C	C
	Lagon 480 E	C	C	—	—	—	—	—	C	SC	C
malathion	Malathion 85E	N	C	—	—	S	—	—	C	—	C
naled	Dibrom	C	—	—	—	—	—	—	—	—	C
lambda-cyhalothrin	Matador 120EC	C	C	—	C	—	C	C	SC	C	—
	Silencer 120 EC	C	C	—	C	—	C	C	SC	C	—
permethrin	Ambush 500EC	—	—	—	—	—	C	—	—	—	—
	Perm-UP	—	—	—	—	—	C	—	—	—	—
	Pounce 384EC	—	—	—	—	—	C	—	—	—	—
imidacloprid	Admire 240 F	C	S	—	—	—	—	—	—	—	—
spinosad	Success	—	—	—	—	—	C	—	—	—	—
	Entrust	—	—	—	—	—	C	—	—	—	—
Bacillus thuringiensis	Bioprotec CAF	—	—	—	—	—	C	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	—	—	C	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	—	C	C	—	—	—
ferric phosphate	Sluggo Professional	—	—	C	—	—	—	—	—	—	—

[1] For information on seed corn maggot and seed treatments for aphid and leafhopper control, see *Table 3–4. Snap and Lima Bean Seed Treatments*, on page 31.

Table 3–8. Snap and Lima Bean Insect Control — Leafhoppers, Bean Beetles, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS, BEAN BEETLES, APHIDS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	Leafhoppers.
			1.25–1.5 L/ha (0.5–0.6 L/acre)	5	Mexican bean beetle. Use low rate on young plants.
organophosphate (group 1B)	dimethoate[1]	Cygon 480[1]	0.7–1 L/ha (0.3–0.4 L/acre)	7	No additional information.
		Lagon 480 E[1]	0.7–1 L/ha (0.3–0.4 L/acre)	7	**Snap beans only.**
	malathion	Malathion 85E	0.73–1.34 L/ha (0.3–0.5 L/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
	naled	Dibrom	1.05–2.1 L/ha (0.4–0.85 L/acre)	4	Aphids. **Lima beans only.** Do not apply when temperature is above 32°C. 48-hr re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin[1]	Matador 120EC[1]	83–233 mL/ha (34–94 mL/acre)	7	Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. 4-hr re-entry interval.
		Silencer 120 EC[1]	83–233 mL/ha (34–94 mL/acre)	7	Snap beans. Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. 24-hr re-entry interval.
				14	Lima beans. Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. 24-hr re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5 mL/100 m of row (2.3 mL/100 ft of row)	21	**Soil application for aphid control only.** See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Controls aphids and suppresses leafhoppers. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. It is recommended that imidacloprid not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.

[1] Do not graze or feed treated foliage to livestock.

Table 3–9. Snap and Lima Bean Insect Control — European Corn Borers, Western Bean Cutworms, Cutworms, Slugs, Brown Marmorated Stink Bugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORERS					
carbamate (group 1A)	methomyl	Lannate TNG	550 g/ha (223 g/acre)	7	12-hr re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin[1]	Matador 120EC[1]	83 mL/ha (34 mL/acre)	7	Apply before corn borer larvae tunnel into the stalk or pods. 24-hr re-entry interval.
		Silencer 120 EC[1]	83 mL/ha (34 mL/acre)	7	Snap beans. Apply before corn borer larvae tunnel into the stalk or pods. 24-hr re-entry interval.
				14	Lima beans. Apply before corn borer larvae tunnel into the stalk or pods. 24-hr re-entry interval.
	permethrin	Ambush 500EC	200 mL/ha (81 mL/acre)	7	**Snap beans only.** 12-hr re-entry interval.
		Perm-UP	260 mL/ha (105 mL/acre)		
		Pounce 384EC			
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	3	**Snap beans only.** Use only on small larvae and low infestations. Maintain a spray pH of 6 or greater. Re-entry permitted when residues are dry.
		Success	83 mL/ha (34 mL/acre)	3	
biological (group 11)	*Bacillus thuringiensis*	Bioprotec CAF	2.8–4.0 L/ha (1.1–1.6 L/acre)	1	**Snap beans only.** Allow 5–10 days between applications.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	2	**Snap beans only.** Apply just prior to egg-hatch. 12-hr re-entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	7	Apply just prior to egg-hatch. See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	12-hr re-entry interval.
WESTERN BEAN CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin[1]	Matador 120EC[1]	83–187 mL/ha (34–76 mL/acre)	7	24-hr re-entry interval.
		Silencer 120 EC[1]	83–187 mL/ha (34–76 mL/acre)	7	Snap beans. 24-hr re-entry interval.
				14	Lima beans. 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	12-hr re-entry interval.
CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin[1]	Matador 120EC[1]	83 mL/ha (34 mL/acre)	7	Apply in the late evening or at night. 24-hr re-entry interval.
		Silencer 120 EC[1]	83 mL/ha (34 mL/acre)	7	Snap beans. Apply in the late evening or at night. 24-hr re-entry interval.
				14	Lima beans. Apply in the late evening or at night. 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Apply to small plants when no rain is forecast in the next 24 hr. 12-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	550 g/ha (223 g/acre)	7	**Suppression only.** Apply when insect first appears. 12-hr re-entry interval.
organophosphate (group 1B)	malathion	Malathion 85E	1.345 L/ha (0.544 L/acre)	3	**Suppression only.**

[1] Do not graze or feed treated foliage to livestock.

BEETS, TABLE

In this section:

Table 3–10. Table Beet Seed Treatments
Table 3–11. Activity of Fungicides on Table Beet Diseases
Table 3–12. Table Beet Disease Control
Table 3–13. Activity of Insecticides on Table Beet Insects
Table 3–14. Table Beet Insect Control — Aphids, Cutworms, Flea Beetles
Table 3–15. Table Beet Insect Control — Leafhoppers, Tarnished Plant Bug, White Grubs

This information is provided as a guideline only. See product labels for complete information.

Table 3–10. Table Beet Seed Treatments

Group Name (Group #)	Active Ingredients	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	pythium damping-off	**For use in seed treatment plant only.**
phenylpyrrole (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	seed- and soil-borne diseases (*Fusarium, Rhizoctonia, Aspergillus, Penicillium*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight, damping-off	Do not graze or feed treated clippings to livestock.

Table 3–11. Activity of Fungicides on Table Beet Diseases

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Alternaria	Botrytis Gray Mold	Cercospora Leaf Spot	Powdery Mildew	Rhizoctonia Root Rot, Crown Rot, Stem Canker
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C
pyraclostrobin	Cabrio EG	C	—	C	C	—
copper sulphate	Copper 53W	—	—	C	—	—

Table 3–12. Table Beet Disease Control

For resistance management, rotate between fungicides from different chemical groups.

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAF SPOT					
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	See label for recropping restrictions. 3-day re-entry interval (hand harvesting); 12-hr re-entry interval for all other activities.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	1	48-hr re-entry interval.
RHIZOCTONIA ROOT AND CROWN ROT					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	One application/yr, applied in-furrow at planting or banded within 30 days of emergence. 12-hr re-entry interval.

Table 3–13. Activity of Insecticides on Table Beet Insects

LEGEND: C = control
RN = reduction in numbers only
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Cutworms	Flea Beetles	Leafhoppers	Lygus Bugs	Stink Bugs	White Grubs
carbaryl	Sevin XLR	—	—	C	C	C	N	—
dimethoate	Cygon 480	C[1]	—	—	C[1]	—	—	—
	Lagon 480 E	C[1]	—	—	C[1]	C	—	—
malathion	Malathion 25W	N	—	—	—	—	—	—
permethrin	Ambush 500EC	—	C	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—
imidacloprid	Admire 240 F	C[2]	—	C	C[2]	—	—	RN[2]
thiamethoxam	Actara 25WG	C	—	—	C	—	—	—
sulfoxaflor	Closer	C	—	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	C	—	—	—	—	—

[1] Beet greens only.
[2] See label for details.

Table 3–14. Table Beet Insect Control — Aphids, Cutworms, Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	12	**Beet greens only.**
		Lagon 480 E	700 mL/ha (283 mL/acre)	21	**Beet greens only.**
	malathion	Malathion 25W	2.25–5.5 kg/ha (0.91–2.22 kg/acre)	7	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.7 mL/100 ft of row)	21	See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	See label for recropping restrictions. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	See label for recropping restrictions. 12-hr re-entry interval.
CUTWORMS					
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	See label for application instructions. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	See label for application instructions. 12-hr re-entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	See label for application instructions. Re-entry permitted once spray deposit has dried.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
FLEA BEETLES					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.7 mL/100 ft of row)	21	See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.

Table 3–15. Table Beet Insect Control — Leafhoppers, Tarnished Plant Bug, White Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	12	**Beet greens only.**
		Lagon 480 E	700 mL/ha (283 mL/acre)	21	**Beet greens only.**
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.7 mL/100 ft of row)	21	See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	**Suppression only.** See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	**Aster leafhopper.** Do not apply a foliar neonicotinoid in the same season as a soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
TARNISHED PLANT BUG					
organophosphate (group 1B)	dimethoate	Lagon 480 E	700 mL/ha (283 mL/acre)	12	**Beet greens only.**
WHITE GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae of European chafer only.** See label for soil application options. Time just prior to or during egg hatch. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.

BRASSICA CROPS

broccoli, Brussels sprouts, cabbage, cauliflower, kale, kohlrabi and specialty vegetables, including headed Chinese cabbage (napa), leafy Chinese cabbage (bok choy, pak choy, etc.), Chinese mustard, broccoli raab, collards, mizuna, mustard greens, mustard spinach and rape greens

In this section:

Table 3-16. Brassica Crop Seed Treatments
Table 3-17. Activity of Fungicides on Brassica Crop Diseases
Table 3-18. Brassica Crop Disease Control for Transplants
Table 3-19. Brassica Crop Disease Control — Downy Mildew
Table 3-20. Brassica Crop Disease Control — Alternaria, Sclerotinia (White Mold, White Rot, Watery Soft Rot)
Table 3-21. Brassica Crop Disease Control — Powdery Mildew, Botrytis Gray Mold
Table 3-22. Activity of Insecticides on Brassica Crop Insects
Table 3-23. Brassica Crop Insect Control — Aphids
Table 3-24. Brassica Crop Insect Control — Cutworms, Leafhoppers, Slugs
Table 3-25. Brassica Crop Insect Control — Cabbage Maggot
Table 3-26. Brassica Crop Insect Control — Flea Beetles
Table 3-27. Brassica Crop Insect Control — Thrips
Table 3-28. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars
Table 3-29. Brassica Crop Insect Control — Swede Midge
Table 3-30. Brassica Crop Insect Control — Leafminers

Pest control products listed in these tables are not necessarily registered on all brassica crops. See the most up-to-date pest control product labels to ensure the registration on a specific crop. This information is provided as a guideline only. See product labels for complete information.

Table 3–16. Brassica Crop Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**For import use only.** Not for domestic, commercial or on-farm seed treatment. Registered on broccoli, Chinese broccoli, Brussels sprouts, cabbage, Chinese napa cabbage, Chinese mustard cabbage, cauliflower, cavalo broccoli, kohlrabi.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	damping-off (*Rhizoctonia solani*)	**For import use only.** Not for domestic, commercial or on-farm seed treatment. Registered on broccoli, Chinese broccoli (gai lon), broccoli raab (rapini), Brussels sprouts, cabbage, Chinese cabbage (bok choy), Chinese cabbage (napa), Chinese cabbage (gai choy), cauliflower, cavolo broccoli, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens.
phenylpyrrole (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	damping-off (*Fusarium* and *Rhizoctonia*)	**For import use only.** Not for domestic, commercial or on-farm seed treatment. Registered on broccoli (including Chinese and raab), Brussels sprouts, cabbage (including Chinese bok choy, Chinese napa and Chinese mustard), collards, kale, kohlrabi, mustard greens, mustard spinach and rape greens, cavalo broccolo, mizuna.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight and damping-off	Seed box treatment. Registered on broccoli, Brussels sprouts, cabbage, cauliflower and mustard.

Table 3–17. Activity of Fungicides on Brassica Crop Diseases

Listed pest control products are not necessarily registered on all brassica crops. See the most up-to-date product label to ensure registration on a specific crop.

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Downy Mildew	Alternaria	Sclerotinia	Powdery Mildew	Botrytis Gray Mold	Clubroot
metalaxyl-M and S	Apron XL LS	C	—	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—	—
cyazofamid	Ranman 400SC	C	S	—	—	—	—	—
	Torrent 400SC	C	S	—	—	—	—	—
captan	Maestro 80DF	C	—	—	—	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	C[1]
boscalid/pyraclostrobin	Pristine WG	—	S	—	—	—	C	—
fenamidone	Reason 500SC	—	S	—	—	—	—	—
fosetyl-AL	Aliette WDG	—	C	—	—	—	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	S	—	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	S	—	—	—	—	—
mandipropamid	Revus	—	C	—	—	—	—	—
dimethomorph	Acrobat 50 WP	—	S	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	C	—	—	—	—	—
Bacillus subtilis	Serenade ASO	—	S	—	S	—	—	—
fluopicolide + chlorothalonil	Presidio + Bravo 500	—	C	—	—	—	—	—
copper sulphate	Copper 53W	—	C	—	—	—	—	—
chlorothalonil	Bravo 500	—	C	C	—	—	—	—
	Echo 90DF	—	C	C	—	—	—	—
iprodione	Rovral	—	—	C	—	—	—	—
difenoconazole	Inspire	—	—	C	—	C	—	—
azoxystrobin	Quadris Flowable	—	—	S	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	C	—	C	—	—
penthiopyrad	Fontelis	—	—	—	S	—	C	—
Coniothyrium minitans	Contans WG	—	—	—	S	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	S	—	C	—	—

[1] Chemical control of clubroot is inconsistent.

Table 3–18. Brassica Crop Disease Control for Transplants

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL (DAMPING-OFF, ROOT ROT)					
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	30 mL/100 L water	60	Brassica transplants. Pythium damping-off and root rot. Make a single application as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not use any surfactant with drench application. 12-hr re-entry interval.
phthalimide (group M4)	captan	Maestro 80DF	1.25 kg/1,000 L of water Apply 50–85 L of solution/100 m².	—	Crucifers. Soil drench treatment. 48-hr re-entry interval.
CLUBROOT (TRANSPLANT TREATMENTS)[1]					
Head and stem brassicas subgroup 5A: (broccoli, Chinese broccoli, Brussels sprouts, cabbages, Chinese napa cabbage, Chinese mustard cabbage, cauliflower, cavalo broccolo, kohlrabi) — as per label					
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	Mix 50 mL with water to make a 100-L solution. Apply 100 mL of solution per plant.	65	Transplant treatment. Apply immediately after transplanting. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			2.9 L in 500 L water/ha	65	Pre-transplant treatment. Apply solution in a minimum band of 25 cm along the row and incorporate to a depth of 15–20 cm. If using transplants, plant the seedlings into the treated band or make a broadcast application prior to bed formation. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
Leafy brassica greens subgroup 5B: (broccoli raab, bok choi, Chinese cabbage, collards, kale, mizuna, mustard greens, rape greens) — as per label					
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	Mix 50 mL with water to make a 100-L solution. Apply 100 mL of solution per plant.	30	Transplant treatment. Apply immediately after transplanting. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			2.9 L in 500 L water/ha	30	Pre-transplant treatment. Apply solution in a minimum band of 25 cm along the row and incorporate to a depth of 15–20 cm. If using transplants, plant the seedlings into the treated band or make a broadcast application prior to bed formation. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.

[1] Chemical control of clubroot is inconsistent.

Table 3–19. Brassica Crop Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1 kg/ha (0.4 kg/acre)	4	**Suppression only.** Also controls botrytis gray mold. See label for complete list of brassica crops, including specialty brassicas. See label for recropping restrictions. Maximum 4 applications/season. 4-day re-entry interval.
QoI (group 11)	fenamidone	Reason 500SC	400–600 mL/ha (162–243 mL/acre)	2	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin applications when conditions are conducive to disease development. See label for recropping restrictions. Maximum 3 applications/season. 2-day re-entry interval.
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	200 mL/ha (81 mL/acre)	1	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin applications when disease is first seen or when weather conditions are conducive to disease development. Tank-mix with non-ionic or organosilicone surfactant; see label for directions. Maximum 5 applications/crop/yr. 12-hr re-entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.25–3.125 kg/ha (0.9–1.3 kg/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Maximum 5 applications/season. 12-hr re-entry interval.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	0	**Preventive suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin preventive applications when conditions favour disease development. Maximum 4 applications/yr. 12-hr re-entry interval.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–6 L/ha (1.2–2.4 L/acre)	1	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin applications when conditions are favourable to disease development. Use higher rate and shorter spray interval when disease pressure is high. Maximum 6 applications/season. 12-hr re-entry interval.
carboxylic acid amide (group 40)	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use a non-ionic adjuvant (0.25% v/v) as suggested on the label. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	7	**Suppression only.** Tank-mix with another fungicide with activity against downy mildew. See label for complete list of brassica crops, including specialty brassicas. See label for recropping restrictions. Maximum 5 applications/season. 7-day re-entry interval for hand-harvesting and irrigation. 5-day re-entry interval for scouting. 12-hr re-entry interval for all other activities.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	0.8–1 L/ha (0.3–0.4 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Begin applications prior to disease development. The addition of a spreading/penetrating adjuvant is suggested at maximum rate 0.125% v/v as per the label. Do not use non-ionic surfactants (e.g., Agral 90, Induce). See label for recropping restrictions. Maximum 3 applications/season. 6-day re-entry interval for hand-harvesting or irrigation. 4-day re-entry interval for scouting. 12-hr re-entry interval for all other activities.

[1] Fixed copper may be phytotoxic to cauliflower.

Table 3–19. Brassica Crop Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW (cont'd)					
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3.2–6 L/acre)	0	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin applications when conditions are conducive to disease development. Repeat at 7–10-day intervals.
benzamide + chloronitrile (group 43+M5)	fluopicolide + chlorothalonil	Presidio + Bravo 500	220–292 mL/ha + 2.5–4.8 L/ha (89–118 mL/acre + 1–1.9 L/acre)	7	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Do not make sequential applications. See label for rotational crop restrictions. 48-hr re-entry interval.
inorganic (group M1)	copper sulphate[1]	Copper 53W[1]	4 kg/ha (1.6 kg/acre)	1	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Maximum 2 applications/yr for Brussels sprouts. Maximum 5 applications/yr for other crops. 48-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.5–4.8 L/ha (1–1.9 L/acre)	7	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** 48-hr re-entry interval.
		Echo 90DF	1.4–2.7 kg/ha (0.6–1.1 kg/acre)	7	

[1] Fixed copper may be phytotoxic to cauliflower.

Table 3–20. Brassica Crop Disease Control — Alternaria, Sclerotinia (White Mold, White Rot, Watery Soft Rot)

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA					
dicarboximide (group 2)	iprodione	Rovral	3 kg/ha (1.2 kg/acre)	7	**Storage cabbage only.** Apply 7–14 days prior to harvest. 12-hr re-entry interval.
				5	**Cauliflower only.** Apply 1–2 days prior to tying. 12-hr re-entry interval.
DMI (group 3)	difenoconazole	Inspire	364–512 mL/ha (147–207 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for recropping restrictions. Maximum of 2.04 L of Inspire/ha/season. 3-day re-entry interval for hand-harvesting or irrigation. 1-day re-entry interval for scouting. 12-hr re-entry interval for all other activities.
QoI (group 11)	azoxystrobin	Quadris Flowable	1.12 L/ha (0.45 L/acre)	1	**Cabbage only. Suppression only.** Maximum 3 applications/season. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. Also suppresses cercospora leafspot (*Cercospora brassicae*); maximum 1 application when targeting this disease. 3-day re-entry interval for hand-harvesting. 1-day re-entry interval for scouting. 12-hr re-entry interval for all other activities.
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.5–4.8 L/ha (1–1.9 L/acre)	7	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** 48-hr re-entry interval.
		Echo 90DF	1.4–2.7 kg/ha (0.6–1.1 kg/acre)	7	
SCLEROTINIA (WHITE MOLD, WHITE ROT, WATERY SOFT ROT)					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	0	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	12–24 L/ha (4.8–9.7 L/acre)	0	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Begin applications when conditions are conducive to disease development. Repeat at 7–10-day intervals.
not classified	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Cabbage only. Suppression only.** Broadcast application, lightly incorporated. Apply to soil prior to or at planting or at time of transplant at least 3 months prior to typical onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details.

Table 3–21. Brassica Crop Disease Control — Powdery Mildew, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 3-day re-entry interval for hand-harvesting. 1-day re-entry interval for scouting. 12-hr re-entry interval for all other activities.
phenylpyrrole/ anilino-pyramidine (group 12/9)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	**Controls powdery mildew on mustard greens only.** Suppresses *Alternaria* on cabbage only. Use high rate for heavy disease pressure. See label for recropping restrictions. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–2.25 L/ha (0.5–0.9 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.

Table 3–22. Activity of Insecticides on Brassica Crop Insects

Listed pest control products are not necessarily registered on all brassica crops.
See the most up-to-date product label to ensure registration on a specific crop.

LEGEND: C = control S = suppression RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	**Trade Name**	**Aphids**	**Cutworms**	**Leafhoppers**	**Slugs**	**Cabbage Maggot**	**Flea Beetles**	**Thrips**	**Imported Cabbageworm**	**Cabbage Looper**	**Diamondback Moth**	**Swede Midge**	**Leafminers**
acephate	Orthene 75 SP	C	—	—	—	—	—	—	C	C	C	—	—
dimethoate	Cygon 480	C	—	C	—	—	—	—	—	—	—	—	—
	Lagon 480 E	C	—	C	—	—	—	C	—	—	—	—	—
malathion	Malathion 85E	N	—	—	—	—	—	—	C	C	—	—	—
naled	Dibrom	C	—	—	—	—	—	—	C	C	C	—	—
acetamiprid	Assail 70 WP	C	—	—	—	—	—	—	—	—	—	C	RD[1]
imidacloprid	Admire 240 F	C	—	S	—	—	—	—	—	—	—	—	—
	Alias 240 SC	C	—	—	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	C	—	—	—	—	S	—	—	—	—	—	—
imidacloprid/deltamethrin	Concept	C	—	—	—	—	C	—	C	C	C	—	—
sulfoxaflor	Closer	C	—	—	—	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—	—	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—	—	—	C	—
cyantraniliprole	Exirel	C	C	—	—	—	—	—	C	C	C	C	C[2]
	Verimark	—	—	—	—	—	RD	—	C	C	C	RD	—
chlorpyrifos	Lorsban 4E/NT	—	C	—	—	C	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	C	—	—	C	—	—	—	—	—	—	—
	Nufos 4E	—	C	—	—	C	—	—	—	—	—	—	—
	Warhawk 480 EC	—	C	—	—	C	—	—	—	—	—	—	—
	Lorsban 50W	—	C	—	—	C	—	—	—	—	—	—	—
	Lorsban 15G	—	—	—	—	C	—	—	—	—	—	—	—
	Pyrifos 15G	—	—	—	—	C	—	—	—	—	—	—	—
cypermethrin	Ripcord 400 EC	—	C	—	—	—	C	C	C	C	C	—	—
	UP-Cyde 2.5 EC	—	—	—	—	—	—	C	C	C	C	—	—
permethrin	Pounce 384EC	—	C	—	—	—	C	—	C	C	C	—	—
	Perm-UP	—	C	—	—	—	C	—	C	C	C	—	—
	Ambush 500EC	—	C	—	—	—	C	—	C	C	C	—	—
chlorantraniliprole	Coragen	—	C	—	—	—	—	—	C	C	C	C	C[3]
ferric phosphate	Sluggo Professional	—	—	—	C	—	—	—	—	—	—	—	—
methomyl	Lannate TNG	—	—	—	C	—	—	—	C	C	C	—	—
carbaryl	Sevin XLR	—	—	C	—	—	C	—	C	—	C	—	—
deltamethrin	Decis 5 EC	—	—	—	—	—	C	—	C	C	C	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	C	C	C	C	C	—
	Silencer 120 EC	—	—	—	—	—	C	C	C	C	C	C	—
spinosad	Entrust	—	—	—	—	—	S	—	C	C	C	—	—
	Success	—	—	—	—	—	—	S	C	C	C	RD	—
	Entrust 80	—	—	—	—	—	S	S	C	C	C	RD	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	C	C	C	—	—
Bacillus thuringiensis	Dipel 2X DF	—	—	—	—	—	—	—	C	C	C	—	—
	Thuricide HPC	—	—	—	—	—	—	—	C	C	C	—	—
	Bioprotec CAF	—	—	—	—	—	—	—	C	C	C	—	—
novaluron	Rimon 10 EC	—	—	—	—	—	—	—	C	C	C	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	—	—	C	C	S	—	—
cyromazine	Citation 75WP	—	—	—	—	—	—	—	—	—	—	—	C[1]

[1] Pea leafminers only.

[2] Dipteran leafminers.

[3] Vegetable and serpentine leafminers only.

Table 3-23. Brassica Crop Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Treatment					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6.5 mL/100 m of row (1.98 mL/100 ft of row)	21	Soil application. See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Alias 240 SC	730 mL/ha (295 mL/acre)	21	Side-dress application. See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Inject to a depth of 2.5 cm, 5–10 cm on each side of each row. See label for rotational crop restrictions. Maximum 1 application/yr. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Also suppresses early-season flea beetles. Soil application at or shortly following seeding or transplanting. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for application details. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatment					
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	28	**Brussels sprouts, cabbage and cauliflower only.** Maximum 2 applications/season. 12-hr re-entry interval.
	dimethoate	Cygon 480	0.7–1 L/ha (0.28–0.4 L/acre)	4	**Broccoli and cauliflower only.**
				21	**Brussels sprouts only.** Use low rate on Brussels sprouts.
			0.7 L/ha (0.28 L/acre)	7	**Kale only.**
			0.6–1 L/ha (0.24–0.4 L/acre)	7	**Chinese broccoli and bok choy only.** Maximum 3 applications/season.
		Lagon 480 E	0.7–1 L/ha (0.28–0.4 L/acre)	4	**Broccoli and cauliflower only.** Maximum 3 applications/season.
				21	**Brussels sprouts only.** Maximum 3 applications/season.
			0.6–1 L/ha (0.24–0.4 L/acre)	7	**Chinese broccoli and bok choy only.** Maximum 3 applications/season.
	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage, cauliflower, kale and kohlrabi only.** Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Maximum 2 applications/season. 48-hr re-entry interval.

Table 3–23. Brassica Crop Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS (cont'd)					
Foliar Treatment (cont'd)					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/ season. 48-hr re-entry interval for scouting. 4-day re-entry interval for all other post-application activities.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Foliar application. See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
		Alias 240 SC	200 mL/ha (81 mL/acre)	7	Foliar application. See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 application/yr. 24-hr re-entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Apply once the target pest has reached an economic threshold. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	**Do not apply to bok choy, napa or mustard spinach.** See label for complete list of brassica crops, including specialty brassicas. Most effective on young stages of pest development. Slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/ additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–24. Brassica Crop Insect Control — Cutworms, Leafhoppers, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT Pyrinex 480 EC Nufos 4E Warhawk 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)	32	**Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage only.** Apply at 2–5-leaf stage. See label for recropping restrictions. 24-hr re-entry interval. 10-day re-entry interval for cauliflower.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	21	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Do not use on muck soils. Do not disturb soil for 5 days after application.
	permethrin	Pounce 384EC Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Use high rate on dry soils or large larvae. Apply up to 5-leaf stage. Do not disturb ground for 5 days following application. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	**Black cutworm only.** See label for complete list of brassica crops, including specialty brassicas. For optimum control, apply with modified seed oil adjuvant (Hasten or MSO). Apply to small plants, when no rain is forecast in next 24 hr. Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
LEAFHOPPERS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	**Suppression only.** Foliar application. See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	—	Use high rates on heavy infestations or after heavy rains.
carbamate (group 1A)	methomyl	Lannate TNG	775 g/ha (314 g/acre)	30	**Brussels sprouts only.** Maximum 1 application/yr. 12-hr re-entry interval.

Table 3–25. Brassica Crop Insect Control — Cabbage Maggot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE MAGGOT					
Transplant Water Treatment					
organophosphate (group 1B)	chlorpyrifos	Lorsban 50W	32.5 g/ 100 L of water Apply 200 mL/plant.	32	**Cabbage only.** Do not use with starter fertilizers. See label for recropping restrictions. 24-hr re-entry interval.
Treatment After Planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	210 mL/ 1,000 m of row	32	**Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval. 10-day re-entry interval for cauliflower.
				15	**Pak choy only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval.
			150 mL in 800 L/ 1,000 m of row	21	**Chinese broccoli only.** Apply 5–7 days after seeding. See label for recropping restrictions. 24-hr re-entry interval.
		Nufos 4E	210 mL/ 1,000 m of row	32	**Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval. 10-day re-entry interval for cauliflower.
				15	**Pak choy only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval.
			150 mL in 800 L/ 1,000 m of row	21	**Chinese broccoli only.** Apply 5–7 days after seeding. See label for recropping restrictions. 24-hr re-entry interval.
		Warhawk 480 EC	210 mL/ 1,000 m of row	32	**Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval. 10-day re-entry interval for cauliflower.
				15	**Pak choy only.** See label for recropping restrictions. Apply in a 10-cm band on each side of the plant 3 days after transplanting or 7–10 days after direct seeding. 24-hr re-entry interval.
			150 mL in 800 L/ 1,000 m of row	21	**Chinese broccoli only.** Apply 5–7 days after seeding. See label for recropping restrictions. 24-hr re-entry interval.
		Pyrinex 480 EC	150 mL in 800 L/ 1,000 m of row	21	**Chinese broccoli only.** Apply 5–7 days after seeding. See label for recropping restrictions. 24-hr re-entry interval.
Treatment at Planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 15G Pyrifos 15G	0.6–1 kg/ 1,000 m of row	32	**Direct-seeded broccoli, Brussels sprouts, cabbage and cauliflower only.** In-furrow, at-planting treatment. See label for recropping restrictions. 24-hr re-entry interval. 10-day re-entry interval for cauliflower.

Table 3–26. Brassica Crop Insect Control — Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	3	**Cabbage and cauliflower only.**
				5	**Broccoli, Brussels sprouts and kohlrabi only.**
				21	**Chinese cabbage, kale and mustard greens only.**
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	87.5–125 mL/ha (35–51 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Maximum 3 applications/season. Do not graze or feed treated foliage to livestock. Do not apply to muck soils.
	deltamethrin	Decis 5 EC	150–200 mL/ha (61–81 mL/acre)	3	**Cabbage only.**
	lambda-cyhalothrin	Matador 120EC, Silencer 120 EC	42 mL/ha (17 mL/acre)	1	**Cabbage only.** Maximum 3 applications/yr. 24-hr re-entry interval.
				3	**Broccoli, Brussels sprouts and cauliflower only.** Maximum 3 applications/yr. 24-hr re-entry interval.
	permethrin	Pounce 384EC, Perm-UP	90–180 mL/ha (36–73 mL/acre)	3	**Brussels sprouts, cabbage and cauliflower only.** 12-hr re-entry interval.
				7	**Broccoli only.** 12-hr re-entry interval.
		Ambush 500EC	70–140 mL/ha (28–57 mL/acre)	3	**Brussels sprouts, cabbage and cauliflower only.** 12-hr re-entry interval.
				7	**Broccoli only.** 12-hr re-entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	**Early-season suppression only.** Soil application at or shortly following seeding or transplanting. See label for complete list of brassica crops, including specialty brassicas. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for application details. See label for rotational crop restrictions. 12-hr re-entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Apply once the target pest has reached an economic threshold. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. 3-day re-entry interval for hand-harvesting, irrigating, pruning, topping, thinning or tying activities. Re-entry permitted for all other activities once spray deposit has dried.
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	**Early season reduction in damage caused by flea beetles only.** In-furrow application, transplant water treatment or banded application. See label for directions. See label for complete list of brassica crops, including specialty brassicas. Do not apply any subsequent applications of Group 28 insecticides following a soil or transplant treatment of cyantraniliprole. See label for rotational crop restrictions. Maximum 1 application/season. Do not exceed 1 L/ha/season. 12-hr re-entry interval.

Table 3–27. Brassica Crop Insect Control — Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	87.5–125 mL/ha (35–51 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Maximum 3 applications/season. Do not graze or feed treated foliage to livestock. Do not apply to muck soils.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Use with Agral 90 (0.03% v/v). Do not apply to muck soils. Maximum 3 applications/season. 12-hr re-entry interval.
	lambda-cyhalothrin	Matador 120EC	188 mL/ha (76 mL/acre)	6	**Hand-harvested crops in Brassica Vegetable Head and Stem Crop Subgroup 5A only.** See label for complete list of brassica crops, including specialty brassicas. Maximum 3 applications/season. 6-day re-entry interval for hand pruning, topping, irrigation, thinning and tying. 4-day re-entry interval for scouting. 24-hr re-entry interval for all other activities.
				1	**Mechanically harvested cabbage only.** Maximum 3 applications/season. 6-day re-entry interval for hand pruning, topping, irrigation, thinning and tying. 4-day re-entry interval for scouting. 24-hr re-entry interval for all other activities.
				3	Other mechanically harvested crops in Brassica Vegetable Head and Stem Crop Subgroup 5A. See label for complete list of brassica crops, including specialty brassicas. Maximum 3 applications/season. 6-day re-entry interval for hand pruning, topping, irrigation, thinning and tying. 4-day re-entry interval for scouting. 24-hr re-entry interval for all other activities.
spinosyn (group 5)	spinosad	Success	146 mL/ha (59 mL/acre)	3	**Suppression only.** See label for complete list of brassica crops, including specialty brassicas. Maximum 3 applications/yr. 3-day re-entry interval for hand-harvesting, irrigating, pruning, topping, thinning or tying activities. Re-entry permitted for all other activities once spray deposit has dried.
		Entrust 80	87.5 g/ha (35.4 g/acre)	3	

Table 3–28. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH CATERPILLAR					
carbamate[1] (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	3	**Cabbage and cauliflower only. Imported cabbageworm and diamondback moth only.**
				5	**Broccoli, Brussels sprouts and kohlrabi only. Imported cabbageworm and diamondback moth only.**
				21	**Chinese cabbage, kale and mustard greens only. Imported cabbageworm and diamondback moth only.**
	methomyl	Lannate TNG	270–540 g/ha (109–219 g/acre)	1	**Cabbage only.** Maximum 3 applications/yr. 2-day re-entry interval for hand pruning/harvesting. 12-hr re-entry interval for all other activities.
				7	**Broccoli, Brussels sprouts and cauliflower only.** Maximum 3 applications/yr. 2-day re-entry interval for hand pruning/harvesting. 12-hr re-entry interval for all other activities.
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	28	**Brussels sprouts, cabbage and cauliflower only.** Maximum 2 applications/season. 12-hr re-entry interval.
	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage, cauliflower, kale and kohlrabi. Imported cabbageworm and cabbage looper only.** Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
	naled	Dibrom	1.05–2.1 L/ha (0.4–0.85 L/acre)	4	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Use high rate for loopers only. Maximum 2 applications/season. 48-hr re-entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Apply once the target pest has reached an economic threshold. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. 3-day re-entry interval for hand harvesting, irrigating, pruning, topping, thinning or tying activities. Re-entry permitted for all other activities once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	3	Also suppresses crucifer flea beetle. See label for complete list of brassica crops, including specialty brassicas. Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. 3-day re-entry interval for hand-harvesting, irrigating, pruning, topping, thinning or tying activities. Re-entry permitted for all other activities once spray deposit has dried.
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use the higher rate for high infestations or advanced growth stages of the target pest. Maximum 3 applications/yr. 12-hr re-entry interval.

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[1] The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–28. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH CATERPILLAR (cont'd)					
pyrethroid[1] (group 3A)	cypermethrin	Ripcord 400 EC	87.5–125 mL/ha (35–51 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Maximum 3 applications/season. Do not graze or feed treated foliage to livestock. Do not apply to muck soils.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	3	**Broccoli, Brussels sprouts, cabbage and cauliflower only.** Use with Agral 90 (0.03% v/v). Do not apply to muck soils. Maximum of 3 applications/yr at 2-week intervals. 12-hr re-entry interval.
	deltamethrin	Decis 5 EC	150–200 mL/ha (61–81 mL/acre)	1	**Brussels sprouts only.**
				3	**Broccoli, cabbage and cauliflower only.**
			200 mL/ha (81 mL/acre)	1	**Kale only.**
	lambda-cyhalothrin	Matador 120EC, Silencer 120 EC	42 mL/ha (17 mL/acre)	1	**Cabbage only.** Imported cabbageworm and diamondback moth larvae. Maximum 3 applications/yr. 24-hr re-entry interval.
				3	**Broccoli, Brussels sprouts and cauliflower only.** Imported cabbageworm and diamondback moth larvae. Maximum 3 applications/yr. 24-hr re-entry interval.
			83 mL/ha (34 mL/acre)	1	**Cabbage only. Cabbage looper only.** Maximum 3 applications/yr. 24-hr re-entry interval.
				3	**Broccoli, Brussels sprouts and cauliflower only. Cabbage looper only.** Maximum 3 applications/yr. 24-hr re-entry interval.
	permethrin	Pounce 384EC	90–180 mL/ha (36–73 mL/acre)	3	**Brussels sprouts, cabbage, and cauliflower only.** 12-hr re-entry interval.
				7	**Broccoli and Chinese broccoli only.** 12-hr re-entry interval.
			180 mL/ha (73 mL/acre)	3	**Pak choy and Chinese cabbage only.** Maximum 4 applications/season. 12-hr re-entry interval.
		Perm-UP	90–180 mL/ha (36–73 mL/acre)	3	**Brussels sprouts, cabbage and cauliflower only.** Add Agral 90 (0.03% v/v) to improve wetting and coverage. 12-hr re-entry interval.
				7	**Broccoli and Chinese broccoli only.** Add Agral 90 (0.03% v/v) to improve wetting and coverage. 12-hr re-entry interval.
			180 mL/ha (73 mL/acre)	3	**Chinese cabbage and pak choy only.** Add Agral 90 (0.03% v/v) to improve wetting and coverage. 12-hr re-entry interval.
		Ambush 500EC	70–140 mL/ha (28–57 mL/acre)	3	**Brussels sprouts, cabbage and cauliflower only.** 12-hr re-entry interval.
				7	**Broccoli only.** 12-hr re-entry interval.
			140 mL/ha (57 mL/acre)	3	**Chinese cabbage and pak choy only.** Maximum 4 applications/season. 12-hr re-entry interval.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha in 200–400 L water (166–332 mL/acre in 18–36 gal water)	2–4	**Broccoli, Chinese broccoli, Brussels sprouts, cabbage, Chinese cabbage, gai choy, cauliflower, cavalo broccoli and kohlrabi only.** Maximum 3 applications/season. 12-hr re-entry interval.
				7	**Broccoli raab (rapini), Chinese cabbage (bok choy), collards, kale, mizuna, mustard greens, mustard spinach and rape greens only.** Maximum 3 applications/season. 12-hr re-entry interval.

[1] The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–28. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH CATERPILLAR (cont'd)					
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	**Broccoli, cabbage, cauliflower, Chinese cabbage, bok choy, Chinese broccoli, mustard greens, kale only. Cabbage loopers only.**
			55–140 g/ha (22–57 g/acre)	0	**Broccoli only. Diamondback moth and imported cabbageworms only.**
			55–275 g/ha (22–111 g/acre)	0	**Cabbage only. Imported cabbageworm only.**
			275 g/ha (111 g/acre)	0	**Cabbage, Chinese cabbage, bok choy, Chinese broccoli only. Diamondback moth only.**
			55–140 g/ha (22–57 g/acre)	0	**Cauliflower, Chinese cabbage, bok choy, Chinese broccoli only. Imported cabbageworm only.**
		Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	**Broccoli, Brussels sprouts, cabbage, cauliflower, kale, mustard greens only. Cabbage loopers only.** Use higher rates for heavy infestations or when foliage is dense.
					Broccoli, Brussels sprouts, cabbage, cauliflower only. Imported cabbageworm and diamondback moth only. Use higher rates for heavy infestations or when foliage is dense.
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	**Broccoli, Brussels sprouts, cabbage, cauliflower, bok choy, Chinese cabbage, Chinese broccoli, collards, kale, mustard greens only.**
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	**Suppression of diamondback moth only. Control of imported cabbageworm and cabbage looper only.** See label for complete list of brassica crops, including specialty brassicas. Apply at first sign of feeding damage or when infestations reach threshold levels as determined by monitoring. Use high rate for heavy infestations or advanced pest growth stages. Tank-mix with a non-ionic surfactant (i.e., Agral 90 or Companion) at the rate of 0.25% v/v. See label for rotational crop restrictions. Do not exceed 2 L product/ha/year. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	In-furrow application, transplant water treatment or banded application. See label for directions. See label for complete list of brassica crops, including specialty brassicas. Do not apply any subsequent applications of Group 28 insecticides following a soil or transplant treatment of cyantraniliprole. See label for rotational crop restrictions. Maximum 1 application/season. Do not exceed 1 L/ha/season. 12-hr re-entry interval
		Exirel	250–500 mL/ha (101–202 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. For optimum control, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	Maximum 4 applications/season. 12-hr re-entry interval.

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[1] The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–29. Brassica Crop Insect Control — Swede Midge

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SWEDE MIDGE					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC, Silencer 120 EC	83 mL/ha (34 mL/acre)	1	**Cabbage only.** Maximum 3 applications/yr. 24-hr re-entry interval.
				3	**Broccoli, Brussels sprouts and cauliflower only.** Maximum 3 applications/yr. 24-hr re-entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 48-hr re-entry interval for scouting. 4-day re-entry interval for all other post-application activities.
spinosyn (group 5)	spinosad	Entrust 80	87.5 g/ha (35 g/acre)	3	**Reduction in damage only.** See label for complete list of brassica crops, including specialty brassicas. Maximum 3 applications/yr. 3-day re-entry interval for hand harvesting, irrigating, pruning, topping, thinning or tying activities. Re-entry permitted for all other activities once spray deposit has dried.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	**Do not apply to bok choy, napa or mustard spinach.** See label for complete list of all brassica crops, including specialty brassicas. Use high rate when pest pressure is high. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	**Early-season reduction in damage caused by Swede midge only.** In-furrow application, transplant water treatment or banded application. See label for directions. See label for complete list of brassica crops, including specialty brassicas. Do not apply any subsequent applications of Group 28 insecticides following a soil or transplant treatment of cyantraniliprole. See label for rotational crop restrictions. Maximum 1 application/season. Do not exceed 1 L/ha/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. For optimum control, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. For optimum control, apply with modified seed oil adjuvant (Hasten or MSO). Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–30. Brassica Crop Insect Control — Leafminers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	**Reduction in damage caused by pea leafminer only.** See the label for a complete list of all brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 48-hr re-entry interval for scouting. 4-day re-entry interval for all other post-application activities.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha in 200 L water (76 g/acre in 20 gal water)	7	**Pea leafminer only. Leafy brassica greens only.** See the label for a complete list of all brassica crops, including specialty brassicas. See label for rotational crop restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Dipteran leafminers. See the label for a complete list of all brassica crops, including specialty brassicas. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. For optimum control, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

CARROTS

In this section:

Table 3-31. Carrot Seed Treatments
Table 3-32. Activity of Fungicides on Carrot Diseases
Table 3-33. Carrot Disease Control — Leaf Blights
Table 3-34. Carrot Disease Control — Damping-Off, Cavity Spot, Rhizoctonia Crown Rot and Root Rot, Sclerotinia White Mold
Table 3-35. Activity of Insecticides on Carrot Insects
Table 3-36. Carrot Insect Control — Leafhoppers, Carrot Weevil
Table 3-37. Carrot Insect Control — Carrot Rust Fly, Cutworms, European Chafer Grubs

This information is provided as a guideline only. See product labels for complete information.

Table 3-31. Carrot Seed Treatments

Group Name (Group #)	Active Ingredient	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**For use in commercial seed-treatment plants only.**
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight, damping-off	Seed box treatment.
dicarboximide (group 2)	iprodione	Rovral	521 mL/ 100 kg seed	seed-borne alternaria	**For imported seed only.**
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	seed rot, damping-off (*Rhizoctonia solani*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–32. Activity of Fungicides on Carrot Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off (*Pythium* spp.)	Alternaria Leaf Blight	Cercospora Leaf Blight	Powdery Mildew	Cavity Spot (*Pythium* spp.)	Rhizoctonia Crown/ Root Rot	Sclerotinia White Mold	Botrytis Gray Mold
fenamidone	Reason 500SC	C	—	—	—	C	—	—	—
chlorothalonil	Bravo 500	—	C	C	—	—	—	—	—
	Echo 90DF	—	C	C	—	—	—	—	—
mancozeb	Manzate Pro-Stick	—	C	C	—	—	—	—	—
	Dithane Rainshield	—	C	C	—	—	—	—	—
	Penncozeb 75DF Raincoat	—	C	C	—	—	—	—	—
metiram	Polyram DF	—	C	C	—	—	—	—	—
copper sulphate	Copper 53W	—	—	C	—	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	—	C	C	C	—	—	—	—
trifloxystrobin	Flint	—	C	C	—	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	C	C	—	—	—	—	—
boscalid	Cantus WDG	—	C	—	—	—	—	—	—
penthiopyrad	Fontelis	—	C	—	S	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	—	—	—	C
fluazinam	Allegro 500F	—	C	—	—	—	—	C	—
metalaxyl	Ridomil Gold 1G	—	—	—	—	C	—	—	—
cyazofamid	Ranman 400SC	—	—	—	—	S[1]	—	—	—
	Torrent 400SC	—	—	—	—	S[1]	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	—	C	—	—
fludioxonil	Scholar 230SC	—	—	—	—	—	—	C	—
Coniothyrium minitans	Contans WG	—	—	—	—	—	—	S	—
Bacillus subtilis	Serenade ASO	—	—	—	—	—	—	S	—

[1] Suppression of cavity spot, root dieback/forking caused by *Pythium* spp.

Table 3–33. Carrot Disease Control — Leaf Blights

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF BLIGHTS					
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.4–3.2 L/ha (1–1.3 L/acre)	1	Alternaria & cercospora leaf blights. 48-hr re-entry interval.
		Echo 90DF	1.3–1.8 kg/ha (0.53–0.73 kg/acre)		Alternaria & cercospora leaf blights. Maximum 7 applications/season. 48-hr re-entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25 kg/ha (0.9 kg/acre)	7	Alternaria & cercospora leaf blights. Do not feed treated tops to livestock. 24-hr re-entry interval.
		Dithane Rainshield			
		Penncozeb 75DF Raincoat			
	metiram	Polyram DF	2.25 kg/ha (0.9 kg/acre)	7	Alternaria & cercospora leaf blights. Do not feed treated tops to livestock.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	1	**Cercospora leaf blight only.** Ensure thorough plant coverage. Maximum 5 applications/yr. 48-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria leaf blight. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
			0.56–0.84 kg/ha (226–340 g/acre)	3	Cercospora leaf blight. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Alternaria & cercospora leaf blights. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–404 mL/acre)	7	Alternaria & cercospora leaf blights. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	580–735 g/ha (234–297 g/acre)	0	**Alternaria leaf blight only.** Do not make sequential applications. Use high rate under heavy disease pressure. See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for hand harvesting. Re-entry permitted for all other activities once spray deposit has dried.
SDHI (group 7)	boscalid	Cantus WDG	315 g/ha (127 g/acre)	0	**Alternaria leaf blight only.** See label for recropping restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–2.25 L/ha (0.5–0.9 L/acre)	0	**Alternaria leaf blight only.** Also suppresses powdery mildew. Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
phenylpyrrole/ anilino-pyrimidine (group 12/9)	fludioxonil/ cyprodinil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	**Alternaria leaf blight only.** Also controls botrytis gray mold. A minimum spray volume of 200 L/ha is recommended. Maximum 2 sequential applications. Use high rate under high disease pressure. See label for recropping restrictions. 12-hr re-entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	1.16 L/ha (0.47 L/acre)	7	**Alternaria leaf blight only.** See label for recropping restrictions. Maximum 4 applications/season. 24-hr re-entry interval.

Table 3–34. Carrot Disease Control — Damping-Off, Cavity Spot, Rhizoctonia Crown Rot and Root Rot, Sclerotinia White Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DAMPING-OFF (*PYTHIUM* SPP.)					
QoI (group 11)	fenamidone	Reason 500SC	600 mL/ha (243 mL/acre)	14	Post-plant application. First application made within 7 days after planting. Apply in spray volume of 300–750 L/ha, directed at base of the plant or to the soil if plants have not yet emerged. See label for recropping restrictions. Maximum 2 applications/season. Re-entry permitted once spray deposit has dried.
CAVITY SPOT (*PYTHIUM* SPP.)					
phenylamide (group 4)	metalaxyl-M and S	Ridomil Gold 1G	25 kg/treated ha (10 kg/treated acre)	—	Treatment rate varies with bed and planting shoe width. Consult label for calculations. Apply product evenly with seed in the furrow. 12-hr re-entry interval.
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	0.44 L/ha (0.18 L/acre)	30	**Suppression of cavity spot and root dieback/forking caused by *Pythium* spp.** Post-plant, pre-emergent application applied to soil within 3 days after planting OR broadcast or banded application made 14 days after planting directed at base of plant. See label for information on applications. Apply in sufficient water to obtain full coverage and follow with sprinkler irrigation of 1.25–2.5 cm of water. Maximum 1 application/season. 12-hr re-entry interval.
QoI (group 11)	fenamidone	Reason 500SC	600 mL/ha (243 mL/acre)	14	Post-plant application. First application made within 7 days after planting. Apply in spray volume of 300–750 L/ha, directed at base of the plant or to the soil if plants have not yet emerged. See label for recropping restrictions. Maximum 2 applications/season. Re-entry permitted once spray deposit has dried.
RHIZOCTONIA CROWN ROT AND ROOT ROT					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	Apply in-furrow at seeding or as one banded application over the row after emergence or within 30 days of emergence. See label for recropping restrictions. Maximum 1 application/season. 12-hr re-entry interval.
SCLEROTINIA WHITE MOLD					
phenylpyrrole (group 12)	fludioxonil	Scholar 230SC	496 mL/378 L water Can treat up to 90,000 kg of carrots.	—	Apply as a post-harvest dip or drench immediately before storage. Dip for approximately 30 seconds and allow carrots to drain. Maximum 1 application. **Domestic use only. Do not use on carrots destined for the U.S.**
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	1.16 L/ha (0.47 L/acre)	7	See label for recropping restrictions. Maximum 3 applications/yr. 24-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3–6 L/acre)	0	**Suppression only.** Begin application soon after emergence.
not classified	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Suppression only.** Broadcast application, lightly incorporated. Apply to soil prior to or at planting at least 3 months prior to typical onset of disease. Regular use of Contans WG in successive years within a long-term management strategy may improve disease control. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details.

Table 3–35. Activity of Insecticides on Carrot Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	**Trade Name**	**Leafhoppers**	**Aster Leafhoppers**	**Carrot Weevil**	**Carrot Rust Fly**	**Cutworms**	**Aphids**	**European Chafer Grubs**
imidacloprid	Admire 240 F	C or S[1]	—	—	—	—	C	RD
carbaryl	Sevin XLR	C	C	—	—	—	—	—
thiamethoxam	Actara 25WG	—	C	—	—	—	C	—
kaolin clay	Surround WP	—	RD	—	—	—	—	—
phosmet	Imidan 70-WP	—	—	C	—	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	C	C	—	—	—
	Silencer 120 EC	—	—	C	C	—	—	—
cypermethrin	Ripcord 400 EC	—	—	—	C	C	—	—
	UP-Cyde 2.5 EC	—	—	—	C	—	—	—
diazinon	Diazinon 50WSP	—	—	—	C	—	C	—
permethrin	Pounce 384EC	—	—	—	—	C	—	—
	Perm-UP	—	—	—	—	C	—	—
	Ambush 500EC	—	—	—	—	C	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	C	—	—
	Pyrinex 480 EC	—	—	—	—	C	—	—
	Nufos 4E	—	—	—	—	C	—	—
	Warhawk 480 EC	—	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	—	—	C	—	—
flonicamid	Beleaf 50SG	—	—	—	—	—	C	—
sulfoxaflor	Closer	—	—	—	—	—	C	—
malathion	Malathion 85E	—	—	—	—	—	N	—

[1] Level of control for leafhoppers depends on application method.

Table 3-36. Carrot Insect Control — Leafhoppers, Carrot Weevil

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
Soil Treatment					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Leafhoppers. Also controls aphids and flea beetles. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
Foliar Treatment					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	1	Leafhoppers and aster leafhoppers. Use low rate on young plants. Do not graze livestock on carrot tops for 24 hr after treatment.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Foliar application. **Suppression of leafhoppers only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aster leafhoppers. Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
not classified	kaolin	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	May decrease damage caused by aster leafhopper. For early applications, use the higher rate per 500 L water.
CARROT WEEVIL					
organophosphate (group 1B)	phosmet	Imidan 70-WP	1.6 kg/ha (0.6 kg/acre)	40	5-day restricted entry interval. See label for re-entry information. Maximum 2 applications/season.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	14	Make first application at 2–3-leaf stage when insects or damage appear. Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC		7	

Table 3–37. Carrot Insect Control — Carrot Rust Fly, Cutworms, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CARROT RUST FLY					
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL in 550 L water/ha (71 mL in 55 gal water/acre)	35	Do not graze livestock on treated carrot tops. Maximum 3 applications/yr.
		UP-Cyde 2.5 EC	280 mL in 550 L water/ha (113 mL in 55 gal water/acre)	35	Maximum 3 applications/yr. 12-hr re-entry interval.
	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	14	Make first application at 2–3-leaf stage when insects or damage appear. Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC		7	
organophosphate (group 1B)	diazinon	Diazinon 50WSP	1.1 kg/ha (0.4 kg/acre)	10	3-day restricted entry interval.
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
pyrethroid (group 3A)	permethrin[1]	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	
	cypermethrin[1]	Ripcord 400 EC	175 mL/ha (71 mL/acre)	21	Do not disturb soil for 5 days after application. Do not graze livestock on treated carrot tops.
organophosphate (group 1B)	chlorpyrifos[1]	Lorsban 4E/NT	2.4–4.8 L/ha (0.9–1.9 L/acre)	60	Use high rate on large larvae or dry soils. Apply at 2–5-leaf stage. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

[1] Seedling treatments.

CELERY

In this section:

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Table 3-39. Activity of Fungicides on Celery Diseases
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Table 3-41. Celery Disease Control — Pink Rot, Botrytis Gray Mold
Table 3-42. Activity of Insecticides on Celery Insects
Table 3-43. Celery Insect Control — Aphids
Table 3-44. Celery Insect Control — Leafhoppers, Carrot Weevil, Tarnished Plant Bug
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Table 3-46. Celery Insect Control — Leafminers, Brown Marmorated Stink Bug

This information is provided as a guideline only. See product labels for complete information.

Table 3–38. Celery Seed Treatments and Transplant Disease Control

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
Seed Treatments				
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg of seed	Seed box treatment. For seed decay, seedling blight and damping-off.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	**For import use only.** Not for domestic commercial or on-farm seed treatment. For seed rot/pre-emergence damping-off caused by *Rhizoctonia solani*.
Greenhouse Treatments				
phthalamide (group M4)	captan	Maestro 80DF	1.25 kg/ 1,000 L of water Apply 50–85 L of solution/100 m^2.	Soil treatment for damping-off and fungus root rot. 48-hr re-entry interval.

Table 3–39. Activity of Fungicides on Celery Diseases

LEGEND: C = control S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Early Blight	Late Blight	Pink Rot (*Sclerotinia*)	Botrytis Gray Mold
boscalid/pyraclostrobin	Pristine WG	S	S	S	—
azoxystrobin	Quadris Flowable	C	C	—	—
trifloxystrobin	Flint	C	C	—	—
copper sulphate	Copper 53W	C	C	—	—
copper oxychloride	Copper Spray	C	C	—	—
mancozeb	Dithane Rainshield	C	C	—	—
	Penncozeb 75DF Raincoat	C	C	—	—
	Manzate Pro-Stick	C	C	—	—
metiram	Polyram DF	C	C	—	—
chlorothalonil	Bravo 500	C	C	—	—
	Echo 90DF	C	C	—	—
Bacillus subtilis	Serenade Max	—	—	S	S
Coniothyrium minitans	Contans WG	—	—	S	—
penthiopyrad	Fontelis	—	—	—	C

Table 3–40. Celery Disease Control — Leaf Blights

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF BLIGHTS					
SDHI/QoI (group 7/11)	boscalid/pyraclostrobin	Pristine WG	1 kg/ha (0.4 kg/acre)	0	**Suppression only of early and late blight.** Do not make sequential applications. See label for recropping restrictions. Maximum 2 applications/yr for late blight or 1 application/yr for early blight. 9-day re-entry interval for hand-harvesting and thinning. 24-hr re-entry interval for all other activities.
QoI (group 11)	azoxystrobin	Quadris Flowable	672–1,120 mL/ha (272–453 mL/acre)	1	Early and late blight. Use sufficient water volume to provide thorough coverage. Maximum 3 applications/season. 12-hr re-entry interval.
	trifloxystrobin	Flint	190–210 g/ha (77–85 g/acre)	7	Early blight. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
			210 g/ha (85 g/acre)	7	Late blight. Use higher rate and shorter spray interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
inorganic (group M1)	copper sulphate	Copper 53W	3.8 kg/ha (1.5 kg/acre)	1	Early and late blight. Maximum 5 applications/yr. 48-hr re-entry interval.
	copper oxychloride	Copper Spray	4 kg in 1,000 L water/ha (1.6 kg in 90 gal water/acre)	1	
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	2.25 kg/ha (0.9 kg/acre)	14	Early and late blight. Wash and trim at harvest. 24-hr re-entry interval.
		Penncozeb 75DF Raincoat			
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)		
	metiram	Polyram DF	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Early and late blight. **After transplanting only.** Wash and trim at harvest. Use higher rate during periods of rain or heavy dew.
chloronitrile (group M5)	chlorothalonil	Bravo 500	1.6–2.4 L/ha (0.6–0.9 L/acre)	7	Early blight. Apply on a 3–5-day schedule. 48-hr re-entry interval.
			2.4–4 L/ha (0.9–1.6 L/acre)	7	Late blight. Apply on an 8–10-day schedule. 48-hr re-entry interval.
		Echo 90DF	0.9–1.3 kg/ha (0.4–0.5 kg/acre)	7	Early blight. Apply on a 3–5-day schedule. Maximum 9 applications/season. 48-hr re-entry interval.
			1.3–2.3 kg/ha (0.5–0.9 kg/acre)	7	Late blight. Apply on an 8–10-day schedule. Maximum 9 applications/season. 48-hr re-entry interval.

Table 3–41. Celery Disease Control — Pink Rot, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PINK ROT (SCLEROTINIA)					
microbial (group 44)	*Bacillus subtilis*	Serenade Max	1–3 kg/ha (0.4–1.2 kg/acre)	0	**Suppression only.** Make the first application approximately 8 weeks before harvest and repeat in 14-day intervals. Apply in sufficient water to ensure thorough coverage to the base of the plants.
not classified	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Suppression only.** Broadcast application, lightly incorporated. Apply to soil prior to or at planting or at time of transplant at least 3 months prior to typical onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.

Table 3–42. Activity of Insecticides on Celery Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leafhoppers	Aster Leafhoppers	Carrot Weevil	Tarnished Plant Bug	Cabbage Looper	Cutworms	Leafminers	Brown Marmorated Stink Bug
imidacloprid	Admire 240 F	C	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	C	C	—	—	—	—	—	C[1]	—
	Actara 25WG	C	—	—	—	RD	—	—	—	—
acephate	Orthene 75 SP	C[2]	—	—	—	C	—	—	—	—
dimethoate	Lagon 480 E	C	—	—	—	—	—	—	—	—
endosulfan	Thionex 50W WSP	C	—	—	—	—	C	—	—	—
acetamiprid	Assail 70 WP	C	—	—	—	—	—	—	RD[3]	—
sulfoxaflor	Closer	C	—	—	—	—	—	—	—	—
pymetrozine	Fulfill 50WG	C	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—	—
cyantraniliprole	Exirel	C	—	—	—	—	—	C	C[1]	—
carbaryl	Sevin XLR	—	C	C	—	—	—	—	—	—
malathion	Malathion 85E	C	—	C	—	—	—	—	—	S
cypermethrin	Ripcord 400 EC	—	C[4]	—	—	—	—	—	—	—
	UP-Cyde 2.5 EC	—	C[4]	—	—	—	—	—	—	—
kaolin clay	Surround WP	—	—	RD	—	—	—	—	—	—
phosmet	Imidan 70-WP	—	—	—	C	—	—	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	C	—	—	—	—
spinosad	Success	—	—	—	—	—	C	—	—	—
	Entrust	—	—	—	—	—	C	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	C	—	—	—
Bacillus thuringiensis	Thuricide HPC	—	—	—	—	—	C	—	—	—
	Bioprotec CAF	—	—	—	—	—	C	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	C	C	C[5]	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	—	—	C	—	—
	Pyrinex 480 EC	—	—	—	—	—	—	C	—	—
	Nufos 4E	—	—	—	—	—	—	C	—	—
	Warhawk 480 EC	—	—	—	—	—	—	C	—	—
abamectin	Agri-mek 1.9% EC	—	—	—	—	—	—	—	C[3]	—
cyromazine	Citation 75WP	—	—	—	—	—	—	—	C	—

[1] Dipteran leafminers.
[2] Green peach aphids only.
[3] Pea leafminer only.
[4] Potato leafhopper only.
[5] Vegetable and serpentine leafminers only.

Table 3–43. Celery Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Treatments					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	45	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Soil application at or shortly following transplanting. See label for application details. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatments					
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	21	**Green peach aphid only.** Maximum 4 applications/season. 24-hr re-entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the re-entry interval.
	dimethoate	Lagon 480 E	700 mL/ha (283 mL/acre)	3	Apply in minimum of 200 L of water/ha. Maximum 3 applications/season.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.75 kg/ha (0.7 kg/acre)	17	Trim the celery of all outer leaves. Maximum 1 application/season. 4-day re-entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–43. Celery Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS (cont'd)					
Foliar Treatments (cont'd)					
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. Do not apply through irrigation equipment. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Thorough spray coverage is essential for optimum control. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages of pest development. Slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. Do not exceed 730 mL/ha/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–44. Celery Insect Control — Leafhoppers, Carrot Weevil, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	5	Leafhoppers, including aster leafhopper.
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	Aster leafhopper.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	86 mL/ha (35 mL/acre)	7	Potato leafhopper. Maximum 3 applications/season.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	Potato leafhopper. Apply with 500 L of water/ha when insects are first noticed. Avoid application when temperature exceeds 27°C. Maximum 3 applications/season. 12-hr re-entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Leafhoppers. Soil application at or shortly following transplanting. See label for application details. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	May decrease damage caused by aster leafhopper. For early applications, use the higher rate in 500 L water.
CARROT WEEVIL					
organophosphate (group 1B)	phosmet	Imidan 70-WP	1.6 kg/ha (0.65 kg/acre)	40	5-day re-entry interval. See label for re-entry information. Maximum 2 applications/yr.
TARNISHED PLANT BUG					
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	21	Maximum 4 applications/season. 24-hr re-entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (33 mL/acre)	3	Timing of application should be based on monitoring for the presence of vulnerable pest stages and significant populations. Apply in water volume of 500 L/ha for thorough coverage. Maximum 3 applications/season. 24-hr re-entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	7	**Reduction in damage only.** Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 12-hr re-entry interval.

Table 3–45. Celery Insect Control — Cabbage Looper, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.75 kg/ha (0.7 kg/acre)	17	Trim the celery of all outer leaves. Maximum 1 application/season. 4-day re-entry interval.
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	1	Maximum 3 applications/season. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	1	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	Maximum 3 applications/season. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	No additional notes.
		Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	No additional notes.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Apply at first sign of feeding damage or when infestations reach threshold levels as determined by monitoring. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for rotational crop restrictions. Do not exceed 2 L of Intrepid/ha/yr. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos[1]	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	70	Use high rate on large larvae or dry soils. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply to small plants, when no rain is forecast in next 24 hr. Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

[1] Seedling treatments.

Table 3–46. Celery Insect Control — Leafminers, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	**Reduction in damage caused by pea leafminer only.** Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Dipteran leafminers. Soil application at or shortly following transplanting. See label for application details. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
avermectin (group 6)	abamectin	Agri-mek 1.9% EC	0.6–1.1 L/ha (243–445 mL/acre)	14	**Pea leafminer only.** Use lower rate under low pest pressure. Maximum 4 applications/season. Do not make sequential applications. Re-entry permitted once spray deposit has dried.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	Apply when leafminer larvae first appear. See label for rotational crop restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	**Vegetable and serpentine leafminers only.** Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Dipteran leafminers. Use high rate under heavy pest pressure. For optimum control of leafminers, use a spray adjuvant as stated on the Exirel label. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	**Suppression only.** Maximum 1 application/season.

CUCURBITS

cucumber, melons (including cantaloupe, muskmelon, watermelon and bittermelon), pumpkin, squash and gourds

In this section:

Table 3-47. Cucurbit Seed and Planting Treatments

Table 3-48. Activity of Fungicides on Cucurbit Diseases

Table 3-49. Cucurbit Downy Mildew Fungicides

Table 3-50. Cucurbit Disease Control — Angular Leaf Spot, Powdery Mildew

Table 3-51. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium Wilt

Table 3-52. Activity of Insecticides on Cucurbit Insects

Table 3-53. Cucurbit Insect Control — Cucumber Beetles, Aphids

Table 3-54. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

This information is provided as a guideline only. See product labels for complete information. Pest control products listed in these tables are not necessarily registered on all cucurbit crops. See the most up-to-date pest control product labels to ensure the registration on a specific crop.

Table 3–47. Cucurbit Seed and Planting Treatments

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

			Damping-off and early-season root rots caused by:			
Active Ingredients	**Trade Name**	**Rate**	**Fusarium**	**Rhizoctonia**	**Pythium**	**Notes**
prothioconazole	Proline 480 SC	420 mL/ha	C	—	—	Also controls gummy stem blight. Follow soil application with foliar applications. See label for re-entry intervals.
metalaxyl-M and S	Apron XL LS	20–40 mL/ 100 kg seed	—	—	C	**For use on imported seed only.** Do not treat seeds in Canada. May be tank-mixed with Maxim 480FS.
	Ridomil Gold 480SL	2.25–4.5 mL/ 100 m row	—	—	C	**Cucumbers only.** Apply as an 18-cm band centred over the row immediately after seeding or before transplanting followed by 15–25 mm of rain or irrigation. 12-hr re-entry interval.
azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	—	C	—	**For import use only.** Not for domestic, commercial or on-farm treatment. See label for crop rotation restrictions.
fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	C	C	—	May be tank-mixed with Apron XL LS.
cyazofamid	Ranman 400SC	30 mL/100 L water	—	—	C	**Cucumbers only.** Make a single application as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not use any surfactant with drench application. 60-day pre-harvest interval. 12-hr re-entry interval.
	Torrent 400SC	30 mL/100 L water	—	—	C	
Trichoderma harzianum	RootShield Granules	600–750 g/m³ soil or planting mix	S	S	S	**Cucumbers only.** 4-hr re-entry interval.
thiram	Thiram 75 WP	50 g/25 kg seed	C	C	C	No additional information.

Table 3–48. Activity of Fungicides on Cucurbit Diseases

For information on seed decay and root rots, see *Table 3-47. Cucurbit Seed and Planting Treatments*, page 77.

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Downy Mildew	Powdery Mildew	Angular Leaf Spot	Scab	Anthracnose	Alternaria	Gummy Stem Blight/ Black Rot	Phytophthora Blight	Fusarium
difenoconazole	Inspire	—	C	—	—	—	—	S	—	—
myclobutanil	Nova	—	C	—	—	—	—	—	—	—
prothioconazole	Proline 480 SC	—	C	—	—	—	—	C	—	C
azoxystrobin/difenconazole	Quadris Top	—	C	—	—	C	C	C	—	—
boscalid	Cantus WDG	—	—	—	—	—	C	C	—	—
penthiopryad	Fontelis	—	C	—	—	—	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	C	C	—	—
fenamidone	Reason	N	—	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	N	C	—	—	C	C	C	—	—
quinoxyfen	Quintec	—	C	—	—	—	—	—	—	—
cyazofamid	Ranman 400SC	C	—	—	—	—	—	—	—	—
	Torrent 400SC	C	—	—	—	—	—	—	—	—
propamocarb/chlorothalonil	Tattoo C	C	—	—	—	—	—	—	—	—
mono- and dibasic sodium potassium and ammonium phosphites	Phostrol	S	—	—	—	—	—	—	—	—
mandipropamid	Revus	S	—	—	—	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	C	—	—	—	—	—	—	C	—
fluopicolide + chlorothalonil	Presidio Fungicide + Bravo 500	C	C	—	C	C	SC	SC	—	—
Bacillis subtilis	Serenade ASO	S	C	—	—	—	—	—	—	—
copper hydroxide	Coppercide WP	—	—	C	—	—	—	—	—	—
	Parasol WG	—	—	C	—	—	—	—	—	—
copper oxychloride	Copper Spray	S	—	C	—	S	—	—	—	—
copper sulphate	Copper 53W	S	—	C	S	S	—	—	—	—
mancozeb	Dithane Rainshield	S	—	—	C	C	C	C	—	—
	Manzate Pro-Stick	S	—	—	C	C	C	C	—	—
	Penncozeb 80WP	S	—	—	C	C	C	C	—	—
captan	Maestro 80DF	—	—	—	C	C	—	—	—	—
	Supra Captan 80 WDG	—	—	—	C	C	—	—	—	—
folpet	Folpan 80 WDG	—	—	—	—	C	—	—	—	—
chlorothalonil	Bravo 500	S	C	—	C	C	SC	SC	—	—
	Echo 90DF	—	C	—	C	C	SC	SC	—	—
potassium bicarbonate	MilStop	—	S	—	—	—	—	—	—	—
citric and lactic acid	Tivano	—	S	—	—	—	—	—	—	—
extract of *Reynoutria sachalinensis*	Regalia Maxx	—	S	—	—	—	—	—	—	—

Table 3–49. Cucurbit Downy Mildew Fungicides

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Broadspectrum Preventive Fungicides Begin applications no later than vine development or earlier if weather conditions are favourable for downy mildew infections.					
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.4–1.3 kg/acre)	14	24-hr re-entry interval.
		Penncozeb 75DF Raincoat			
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Cucumbers. 24-hr re-entry interval.
			1.1–3.25 kg/ha (0.44–1.3 kg/acre)	14	Pumpkin, melons, squash, cantaloupe. 24-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	4.8 L/ha (1.9 L/acre)	1	48-hr re-entry interval.
Downy Mildew–Targeted Preventive Fungicides Begin applications when weather conditions favour downy mildew or if downy mildew is identified anywhere in the Great Lakes region.					
QiI (group 21)	cyazofamid	Ranman 400SC	150–200 mL/ha (61–81 mL/acre)	1	Do not make sequential applications. 30-day plant-back interval. Tank-mix with an NIS or Organosilicone surfactant. 12-hr re-entry interval.
		Torrent 400SC			
carbamate/ chloronitrile (group 28/M5)	propamocarb/ chlorothalonil	Tattoo C	1.8–2.7 L/ha (0.7–1.1 L/acre)	2	Do not make sequential applications. 48-hr re-entry interval.
phosphonate (group 33)	mono- and dibasic sodium potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	1	**Preventive suppression only.** May be tank mixed with Bravo 500. 12-hr re-entry interval.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	0.8–1 L/ha (0.3–0.4 L/acre)	1	Use of a spreading/penetrating adjuvant may improve performance. See label for crop rotation restrictions and re-entry intervals.
benzamide + chloronitrile (group 43 + M5)	fluopicolide + chlorothalonil	Presidio + Bravo 500	220–292 mL/ha + 4.8 L/ha (89–118 mL/acre + 1.9 L/acre)	2	Also provides suppression of phytophthora blight. See label for crop rotation restrictions. 48-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	5–15 L/ha (2–6 L/acre)	0	**Suppression only.** Begin applications soon after emergence or transplanting.

Table 3–50. Cucurbit Disease Control — Angular Leaf Spot, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANGULAR LEAF SPOT					
inorganic (group M1)	copper sulphate	Copper 53W	2.5–3 kg/ha (1–1.2 kg/acre)	1	48-hr re-entry interval.
	copper hydroxide	Parasol WG	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	1	**Cucumbers only.** 48-hr re-entry interval.
		Coppercide WP			
	copper oxychloride	Copper Spray	3.2–4 kg/ha (1.3–1.6 kg/acre)	1	Use low rate for melons, pumpkins and squash. 48-hr re-entry interval.
POWDERY MILDEW					
DMI (group 3)	difenoconazole	Inspire	512 mL/ha (207 mL/acre)	0	Begin applications prior to disease development. May be tank-mixed with Bravo 500. See label for recropping restrictions. 12-hr re-entry interval.
	myclobutanil	Nova	175 g/ha (71 g/acre)	3	Apply at the first sign of disease development. 12-hr re-entry interval.
	prothioconazole	Proline 480 SC	210–420 mL/ha (85–170 mL/acre)	7	Apply at the first sign of disease development. See label for re-entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	0.71–1 L/ha (287–404 mL/acre)	1	Begin applications prior to disease development. Use high rate when disease pressure is high. See label for rotational crop restrictions. 12-hr re-entry interval.
SDHI (group 7)	penthiopyrad	Fontelis	1.25 L/ha (0.5 L/acre)	1	See label for rotational crop restrictions. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	0.9–1.3 kg/ha (0.3–0.5 kg/acre)	0	Mechanically harvested cucurbit crops. See label for recropping restrictions. See label for re-entry intervals.
				3	Hand-harvested cucurbit crops. See label for recropping restrictions. See label for re-entry intervals.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	Begin applications prior to disease development. See label for recropping restrictions. See label for re-entry intervals.
aza-naphthalene (group 13)	quinoxyfen	Quintec	300–440 mL/ha (121–178 mL/acre)	3	**Melons, pumpkin and winter squash only.** See label for crop rotation restrictions. 12-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	4.8 L/ha (1.9 L/acre)	1	Begin applications prior to disease development. 48-hr re-entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	
plant extract (group P5)	extract of *Reynoutria sachalinensis*	Regalia Maxx	0.125–0.25% v/v in 500–1,000 L water/ha (0.125–0.25% v/v in 200–400 L water/acre)	0	**Suppression only.** Begin applications prior to disease development.
not classified	citric and lactic acid	Tivano	8% dilution in total spray volume of 500–700 L/ha (200–280 L/acre)	0	**Squash and pumpkin only. Suppression only.** Begin applications when conditions are conducive to disease. Surfactants listed on the label can be used to obtain better coverage.
	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.27 kg/acre)	0	**Suppression only.** Ensure thorough spray coverage. 4-hr re-entry interval.

Table 3–51. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium Wilt

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	**Common Name**	**Trade Name**	**Rate**	**PHI**	**Notes**
ALTERNARIA, ANTHRACNOSE, GUMMY STEM BLIGHT, SCAB					
DMI (group 3)	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	7	Gummy stem blight. Apply at planting (see *Table 3-47. Cucurbit Seed and Planting Treatments,* on page 77), followed with foliar applications. See label for re-entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	0.71–1 L/ha (287–404 mL/acre)	1	Alternaria, anthracnose and gummy stem blight. Begin applications prior to disease development. Use high rate when disease pressure is high. See label for rotational crop restrictions. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	460 g/ha (186 g/acre)	0	Alternaria and gummy stem blight. Begin applications prior to disease development. See label for recropping restrictions. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1.3 kg/ha (0.5 kg/acre)	0	Alternaria and gummy stem blight. Mechanically harvested cucurbit crops. See label for recropping restrictions. See label for re-entry intervals.
				3	Alternaria and gummy stem blight. Hand-harvested cucurbit crops. See label for recropping restrictions. See label for re-entry intervals.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	Alternaria, anthracnose and gummy stem blight. Use high rate for gummy stem blight. Begin applications prior to disease development. See label for recropping restrictions. See label for re-entry intervals.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.4–1.3 kg/acre)	14	24-hr re-entry interval.
		Penncozeb 75DF Raincoat			
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Cucumbers. 24-hr re-entry interval.
			1.1–3.25/ha (0.44–1.3 kg/acre)	14	Pumpkin, melons, squash, cantaloupe. 24-hr re-entry interval.
phthalimide (group M4)	captan	Maestro 80DF	2.25–4.25 kg/ha (0.9–1.7 kg/acre)	2	**Cucumber only.** Anthracnose and scab. Use low rate on young plants. 48-hr re-entry interval.
		Supra Captan 80 WDG			
	folpet	Folpan 80 WDG	2.5–5 kg/ha (1–2 kg/acre)	1	**Anthracnose only.** 24-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	4.8 L/ha (1.9 L/acre)	1	Anthracnose and scab. Begin applications prior to disease development. 48-hr re-entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)		
PHYTOPHTHORA BLIGHT					
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	1	Apply before symptoms appear and when the risk of disease Is high. Use of a spreading/penetrating adjuvant may improve performance. See label for recropping restrictions and re-entry intervals. See label for plant-back interval and re-entry intervals.
FUSARIUM WILT					
DMI (group 3)	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	7	Apply at planting (see *Table 3-47. Cucurbit Seed and Planting Treatments,* on page 77), followed with foliar applications. See label for re-entry intervals.

Table 3–52. Activity of Insecticides on Cucurbit Insects

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Squash Bug	Cucumber Beetles	Aphids	Two-Spotted Spider Mite	Cutworms	Brown Marmorated Stink Bug
carbaryl	Sevin XLR	C	C	—	—	C	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	C	—
	Nufos 4E	—	—	—	—	C	—
	Pyrinex 480 EC	—	—	—	—	C	—
	Warhawk 480 EC	—	—	—	—	C	—
malathion	Malathion 25W	—	C	N	—	—	—
	Malathion 85E	—	C	N	—	—	S
endosulfan	Thionex 50W WSP	—	C	C	—	—	—
lambda-cyhalothrin	Matador 120EC	C	C	—	—	—	—
imidacloprid	Admire 240 F	—	C	C	—	—	—
	Alias 240 SC	—	C	SC	—	—	—
	Grapple$_2$	—	C	SC	—	—	—
thiamethoxam	Actara 240SC	—	—	C	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—
spiromesifen	Oberon Flowable	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	C		—	—
cyantraniliprole	Exirel	—	—	C	—	C	—
chlorantraniliprole	Coragen	—	—	—	—	C	—
kaolin clay	Surround WP	—	C	—	—	—	—

Table 3–53. Cucurbit Insect Control — Cucumber Beetles, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUCUMBER BEETLES, APHIDS					
Planting (Soil) Treatment					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	0.42–1 L/ha (170–404 mL/acre) (180-cm row spacing)	21	Use high rate for cucumber beetle. Apply 7.5–18 mL/100 m of row in-furrow at planting or banded soon after planting. See the product labels for details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
		Alias 240 SC Grapple[2]	0.98 L/ha (0.36 L/acre) (183-cm row spacing)	21	Cucumber beetles. Apply 18 mL/100 m of row in-furrow at planting or banded soon after planting. See the product labels for details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
		Admire 240 F Alias 240 SC Grapple[2]	Transplant water: 25 mL/1,000 plants	21	Cucumber beetles. Apply in-furrow at planting or banded soon after planting. Use 150 mL of water per plant. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (151–252 mL/acre)	—	**Aphids only.** Apply in-furrow or banded during planting. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatment					
organophosphate (group 1B)	malathion	Malathion 25W	4.25 kg/ha (1.7 kg/acre)	3	Cucumbers, squash, pumpkins.
			4–5.5 kg/ha (1.6–2.2 kg/acre)	3	Melons.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1 kg/ha (0.44 kg/acre)	13	4-day re-entry interval (cucumbers and melon). 12-day re-entry interval (pumpkins and squash).
pyrethroid (group 3)	lambda-cyhalothrin	Matador 120EC	187–233 mL/ha (76–94 mL/acre)	1	Cucumber beetles. Will also control squash bugs. 24-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	**Aphids only.** Use high rate on high populations or dense foliage. See label for recropping restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	**Aphids only.** Most effective on young stages of pest development. Slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for further details. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	**Aphids only.** Use high rate under heavy pest pressure. Apply with Hasten NT Spray Adjuvant at rate of 0.25% v/v or MSO Concentrate with Leci-Tech at rate of 0.5% v/v. See label for tank-mix directions and rotational crop restrictions. 12-hr re-entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	**Cucumber beetle suppression.** Use the high rate for the first application and the low rate for subsequent applications. Surround leaves with a white residue on leaves and fruit. Do not apply when bees are active in the crop or close to harvest.

Table 3–54. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TWO-SPOTTED SPIDER MITE					
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Apply before mite populations begin to build. Slow activity; control may not be apparent for 2–3 weeks. 12-hr re-entry interval.
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	**Climbing cutworms only.** Do not apply during bloom.
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT Nufos 4E Pyrinex 480 EC Warhawk 480 EC	1.2–2.4 L/ha (0.48–0.97 L/acre)	60	**Cucumbers only.** Apply at 2–5-leaf stage. See label for recropping restrictions. 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Apply to small plants when no rain is forecast in next 24 hr. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix directions and rotational crop restrictions 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate	malathion	Malathion 85E	880 mL/ha (356 mL/acre)	3	**Suppression only. Cucumbers, squash and pumpkins only.**
			1,345 mL/ha (544 mL/acre)	3	**Suppression only. Melons only.**

EGGPLANT

In this section:

Table 3-55. Eggplant Seed Treatment and Transplant Production Disease and Insect Control
Table 3-56. Activity of Fungicides on Eggplant Diseases
Table 3-57. Eggplant Disease Control
Table 3-58. Activity of Insecticides on Eggplant Insects
Table 3-59. Eggplant Insect Control — Aphids
Table 3-60. Eggplant Insect Control — Colorado Potato Beetle
Table 3-61. Eggplant Insect Control — Cutworms, Flea Beetles, Mites
Table 3-62. Eggplant Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

This information is provided as a guideline only. See product labels for complete information.

Table 3–55. Eggplant Seed Treatment and Transplant Production Disease and Insect Control

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
Seed and Seedling Disease				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg of seed	Seed treatment. **Pythium damping-off. For use in seed treatment plant only.**
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed treatment. **Seed rot, pre-emergence damping-off caused by *Rhizoctonia solani*.** Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting.
phenylpyrrole (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed treatment. **Seed decay, damping-off and seedling blight caused by *Fusarium* and *Rhizoctonia*. For use by commercial seed treaters only.**
dithiocarbamate (group M3)	thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	Seed treatment. **Seed decay, seedling blight, damping-off.**
Soil Treatments				
pthalamide (group M4)	captan	Maestro 80DF	1.25 kg/ 1,000 L of water Apply 50–85 L of solution per 100 m^2.	Soil drench treatment. **Damping-off, fungus root rot.** 48-hr re-entry interval.
		Supra Captan 80 WDG	1.25 kg/ 1,000 L of water Apply 50–85 L of solution per 100 m^2.	Soil drench treatment. **Damping-off, fungus root rot.** 48-hr re-entry interval.
Insects				
not classified	*Beauveria bassiana*	BotaniGard 22WP	250–500 g/ 400 L of water Spray to wet, but avoid runoff.	**Whiteflies, aphids.** 4-hr re-entry interval.
			500–1,000 g/ 400 L of water Spray to wet, but avoid runoff.	**Thrips.** 4-hr re-entry interval.

Table 3–56. Activity of Fungicides on Eggplant Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

		Greenhouse (transplants)		**Field**			
Common Name	**Trade Name**	**Damping-Off (Seedlings)**	**Root Disease**	**Alternaria (Early Blight)**	**Anthracnose**	**Botrytis Gray Mold**	**Phytophthora Blight**
difenoconazole	Inspire	—	—	C	C	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	C	C	—	—
boscalid	Cantus WDG	—	—	C	—	C	—
penthiopyrad	Fontelis	—	—	S	—	C	—
pyraclostrobin	Cabrio EG	—	—	C	C	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	S[1]
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	S
Bacillus subtilis	Serenade ASO	—	—	S	—	S	—
copper sulphate	Copper 53W	—	—	C	—	—	—
captan	Maestro 80DF	C	C	—	—	—	—
	Supra Captan 80 WDG	C	C	—	—	—	—

[1] See label for details.

Table 3–57. Eggplant Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, ALTERNARIA (EARLY BLIGHT)					
DMI (group 3)	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	0	**Anthracnose and alternaria.** Use high rate for anthracnose control. See label for recropping restrictions. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	**Alternaria.** Also controls botrytis gray mold at 420 g/ha rate. See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	**Alternaria. Suppression only.** See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	**Alternaria, anthracnose.** See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	**Alternaria, anthracnose.** Do not apply until 21 days after transplanting or 35 days after seeding. See label for recropping restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3.2–6.1 L/acre)	0	**Alternaria. Suppression only.**
inorganic (group M1)	copper sulphate	Copper 53W	4 kg in 1,000 L of water/ha (1.6 kg in 405 L of water/acre)	1	**Alternaria.** 48-hr re-entry interval.
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	**Phytophthora foliar blight. Suppression only.** May be applied as foliar sprays or through sprinkler chemigation. 12-hr re-entry interval.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	**Suppression only.** If products from other fungicide groups are not available for rotation, apply only 1 spray/season, applied preventively before symptoms appear and when the risk of disease is high. Follow label instructions regarding adding a spreading/penetrating adjuvant to improve performance. See label for recropping restrictions. 12-hr re-entry interval.
BOTRYTIS (GRAY MOLD)					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	See label for rotational crop restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–15 L/ha (1.6–6.1 L/acre)	0	**Suppression only.**

Table 3–58. Activity of Insecticides on Eggplant Insects

LEGEND: C = control
RD = reduction in damage
S = suppression
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

		Greenhouse (Transplant)	**Field**							
Common Name	**Trade Name**	**Whitefly, Aphids, Thrips**	**Aphids**	**Colorado Potato Beetle**	**Cutworms (Early-Season)**	**Flea Beetle**	**Mites**	**Stink Bug**	**Brown Marmorated Stink Bug**	**Tarnished Plant Bug**
carbaryl	Sevin XLR	—	—	N	—	C	—	N	—	C
dimethoate	Cygon 480	—	—	—	—	—	—	—	—	C
	Lagon 480 E	—	—	—	—	—	—	—	—	C
malathion	Malathion 25W	—	N	—	—	—	—	—	—	—
	Malathion 85E	—	N	—	—	—	N	—	S	—
endosulfan	Thionex EC	—	C	C	—	C	—	—	—	—
	Thionex 50W WSP	—	C	C	—	C	—	—	—	—
imidacloprid	Admire 240 F	—	C[1]	C[1]	—	—	—	—	—	—
	Alias 240 SC	—	—	C	—	—	—	—	—	—
	Grapple$_2$	—	—	C	—	—	—	—	—	—
thiamethoxam	Actara 25WG	—	C	—	—	—	—	C[1]	RD	C[1]
	Actara 240SC	—	C	C	—	S[1]	—	—	—	—
spinosad	Entrust	—	—	C	—	—	—	—	—	—
	Success	—	—	C	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—	—	—	—
acequinocyl	Kanemite 15 SC	—	—	—	—	—	C	—	—	—
spiromesifen	Oberon Flowable	—	—	—	—	—	C	—	—	—
spirotetramat	Movento 240 SC	—	C	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	C	—	—	—	—	—
cyantraniliprole	Exirel	—	C	C	C	—	—	—	—	—
Beauveria bassiana	BotaniGard 22WP	C	—	—	—	—	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	—	C	—	—	—

[1] See label for details.

Table 3–59. Eggplant Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Treatment					
neonicotinoid (group 4A)	imidacloprid	Admire 240F	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
		Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatment					
organophosphate (group 1B)	malathion	Malathion 25W	2.25–5.5 kg/ha (0.91–2.22 kg/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–2.25 kg/ha (0.45–0.91 kg/acre)	27	9-day re-entry interval.
		Thionex EC	1.25–2.5 L/ha (0.51–1.0 L/acre)	27	4-day re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Label directions require a tank mix with a specified spray adjuvant/additive. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	For optimum control of aphids, follow label instructions regarding use of a spray adjuvant. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–60. Eggplant Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
Transplant or Soil Treatments					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	—	See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Alias 240 SC	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)	70	Apply in-furrow at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Grapple[2]			
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Apply in-furrow at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatments					
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–2.25 kg/ha (0.45–0.91 kg/acre)	27	9-day re-entry interval.
		Thionex EC	1.25–2.5 L/ha (0.51–1.0 L/acre)	27	4-day re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Alias 240 SC			
		Grapple[2]			
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Use only on small larvae and low infestations. Maintain a spray water pH of 6 or higher. Re-entry permitted once spray deposit has dried.
		Success	83 mL/ha (34 mL/acre)	1	
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (304–405 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–61. Eggplant Insect Control — Cutworms, Flea Beetles, Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	45 mL/100 m of row (14 mL/100 ft of row)	2	Apply in 25–30 cm band over row.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions.12-hr re-entry interval.
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	2	No additional information.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–2.25 kg/ha (0.45–0.91 kg/acre)	27	9-day re-entry interval.
		Thionex EC	1.25–2.5 L/ha (0.51–1.01 L/acre)	27	4-day re-entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	**Early-season suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
MITES					
acequinocyl (group 20B)	acequinocyl	Kanemite 15 SC	2.1 L/ha (0.85 L/acre)	1	Apply as a full coverage spray to the foliage to drip. See label for recropping restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. See label for rotational crop restrictions. 12-hr re-entry interval.
bifenazate (group UN)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr re-entry interval.

Table 3–62. Eggplant Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides with different modes of action.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	No additional notes.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,345 mL/ha (544 mL/acre)	3	**Suppression only.**
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	**Reduction in damage only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
TARNISHED PLANT BUG					
organophosphate (group 1B)	dimethoate	Cygon 480	500–700 mL/ha (202–283 mL/acre)	7	No additional notes.
		Lagon 480 E			
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

GARLIC

In this section:

Table 3-63. Activity of Fungicides on Garlic Diseases
Table 3-64. Garlic Disease Control — Allium White Rot, Penicillium, Downy Mildew
Table 3-65. Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch
Table 3-66. Activity of Insecticides on Garlic Insects
Table 3-67. Garlic Insect Control — Onion Maggot, Aphids, Leek Moth
Table 3-68. Garlic Insect Control — Thrips

This information is provided as a guideline only. See product labels for complete information.

Table 3–63. Activity of Fungicides on Garlic Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Penicillium (Green Mold)	Botrytis Leaf Blight	Botrytis Neck Rot	Downy Mildew	Purple Blotch	Allium White Rot
iprodione	Rovral	C	—	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	S	C	—
azoxystrobin/difenoconazole	Quadris Top[1]	—	C	—	C	C	—
pyrimethanil	Scala SC	—	C	C	—	C	—
Bacillus subtilis	Serenade Max	—	S	S	S	—	—
pyraclostrobin	Cabrio EG	—	—	—	C	C	—
mandipropamid	Revus	—	—	—	C	—	—
dimethomorph	Acrobat 50 WP	—	—	—	S	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	C	—	—
difenoconazole	Inspire	—	—	—	—	C	—
penthiopyrad	Fontelis[2]	—	—	—	—	S	—
dicloran	Botran 75W	—	—	—	—	—	C
diallyl disulfide	DADS	—	—	—	—	—	S

[1] Also controls cladiosporium leaf blotch.

[2] Also suppresses botrytis fleck caused by *Botrytis cinerea*.

Table 3–64. Garlic Disease Control — Allium White Rot, Penicillium, Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALLIUM WHITE ROT					
aromatic hydrocarbons (group 14)	dicloran	Botran 75W	6 kg/ha (2.4 kg/acre)	—	Apply 1–2 weeks prior to planting and work into top 4 cm of soil. 12-hr re-entry interval.
not classified	diallyl disulfide	DADS	10 L/ha (4 L/acre)	—	**Suppression only.** Soil-injected into seed-bed–ready fields at least 6 months before planting alliums. Seal soil immediately after application with mechanical packer. Use minimum of 500 L of water/ha. See label for application details.
PENICILLIUM OR GREEN MOLD					
dicarboximide (group 2)	iprodione	Rovral	4 g/L of water	—	Dip cloves into the Rovral suspension for 30 minutes immediately before planting. 12-hr re-entry interval.
DOWNY MILDEW					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	**Suppression only.** Use high rate for suppression of downy mildew. Do not make sequential applications. See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities once spray deposit has dried.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	7	See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for thinning activities. 12-hr re-entry interval for all other activities.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Also controls cladosporium leaf blotch. Use high rate and tighter interval if disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
carboxylic acid amide (group 40)	mandipropamid	Revus	400 mL/ha (162 mL/acre)	7	Use a non-ionic adjuvant (0.25% v/v) or mineral oil (1% v/v) as per label directions. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	**Suppression only.** Tank-mix with another fungicide with activity against downy mildew. See label for recropping restrictions. Maximum 5 applications/yr. 2-day re-entry interval for thinning. 12-hr re-entry interval for all other activities.
QxI/ carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Begin applications prior to disease development. The addition of a spreading/penetrating adjuvant may improve performance. See label for recropping restrictions. Maximum 3 applications/season. 24-hr re-entry interval for hand-harvesting and thinning. 12-hr re-entry interval for all other activities.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–6 kg/ha (1.2–2.4 kg/acre)	0	**Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development.

Table 3–65. Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities once spray deposit has dried.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Use high rate and tighter interval if disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
anilino-pyrimidines (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Also controls botrytis neck rot (*Botrytis allii*). Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. Do not apply more than 6.0 L/ha/season. 24-hr re-entry interval for hand thinning. 12-hr re-entry interval for all other activities.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–4.5 kg/ha (1.2–1.8 kg/acre)	0	**Suppression only.** Also suppresses botrytis neck rot (*Botrytis allii*). Begin applications at the first sign of disease or when conditions favour disease development.
PURPLE BLOTCH					
DMI (group 3)	difenoconazole	Inspire	364–512 mL/ha (147–207 mL/acre)	7	See label for recropping restrictions. Maximum 2.04 L/ha/year. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Also controls cladosporium leaf blotch. Use high rate and tighter interval if disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities when residues are dry.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	7	See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for thinning activities. 12-hr re-entry interval for all other activities.
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	**Suppression only.** Also suppresses botrytis fleck caused by *Botrytis cinerea*[1]. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Do not apply more than 5.25 L/ha/season. 12-hr re-entry interval.
anilino-pyrimidine (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. Do not apply more than 6 L/ha/season. 24-hr re-entry interval for hand-thinning. 12-hr re-entry interval for all other activities.

[1] Botrytis fleck is caused by *Botrytis cinerea*, which is different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–66. Activity of Insecticides on Garlic Insects

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leek Moth	Thrips	Onion Maggot	Cutworms
chlorpyrifos	Lorsban 4E/NT	—	—	—	C	C
	Pyrinex 480 EC	—	—	—	C	C
	Nufos 4E	—	—	—	C	C
	Warhawk 480 EC	—	—	—	C	C
malathion	Malathion 85E	C	—	C	—	—
lambda-cyhalothrin	Matador 120EC	—	C	C	—	—
	Silencer 120 EC	—	—	C	—	—
spinetoram	Delegate WG	—	S	S	—	—
spinosad	Success	—	S	S	—	—
	Entrust 80	—	S	S	—	—
Bacillus thuringiensis	Bioprotec CAF	—	S	—	—	—
abamectin	Agri-mek 1.9% EC	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—
cyantraniliprole	Exirel	—	—	S	—	—

Table 3–67. Garlic Insect Control — Onion Maggot, Aphids, Leek Moth

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION MAGGOT					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	3.5 L in 1,000 L of water/ha (1.4 L in 90 gal of water/acre)	50	Apply as a drench over the row on newly emerged plants (in the spring). See label for recropping restrictions. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	No additional notes.
LEEK MOTH					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL in 500 L water/ha (76 mL in 45 gal water/acre)	14	Maximum 3 applications/yr. 24-hr re-entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	**Suppression only.** Apply 1 week after peak pheromone trap capture. Use higher rates when pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. 12-hr re-entry interval for Delegate. Re-entry permitted when once spray deposits have dried for Success and Entrust.
	spinosad	Success[1]	218–262 mL/ha (88–106 mL/acre)		
		Entrust 80[1]	131–158 g/ha (53–63 g/acre)		
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec CAF	1.4–2.8 L/ha (0.5–1.1 L/acre)	0	**Suppression only.** Apply 7–10 days after peak pheromone capture.

[1] Maintain a spray water pH of 6 or greater.

Table 3–68. Garlic Insect Control — Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate per Hectare	PHI	Notes
THRIPS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	No additional notes.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL in 500 L water/ha (76 mL in 45 gal water/acre)	14	Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC			
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (80–136 g/acre)	3	**Suppression only.** Apply according to monitoring when onion thrips first appear. Use high rate when pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. 12-hr re-entry interval for Delegate. Re-entry permitted once spray deposits have dried for Success and Entrust.
	spinosad	Success[1]	218–262 mL/ha (88–106 mL/acre)		
		Entrust 80[1]	131–158 g/ha (53–63 g/acre)		
avermectin (group 6)	abamectin	Agri-mek 1.9% EC[2]	600–1,200 mL/ha (243–485 mL/acre)	30	Apply when onion thrips or signs of feeding first appear. Non-ionic spreading and penetrating surfactants used at a rate of 0.25%–0.5% v/v may improve control. Do not use binder or sticker-type surfactants. Follow surfactant label carefully and test a small number of plants before treating a large area.[2] Maximum 3 applications/season. Re-entry permitted once spray deposit has dried.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (147 mL/acre)	3	Apply when thrips are first noticed. Movento should be used during the first half of the season when adult populations are relatively low or building. Reduction in numbers of thrips larvae may take 3–4 days after application. Label directions require a tank mix with a specified spray adjuvant/additive. See label for application details. See label for recropping restrictions. Maximum 2 applications/season with a minimum of 7 days between applications. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	**Suppression only.** Begin applications when thrips populations are low. If thrips populations are high, use a registered insecticide with different mode of action to reduce thrips populations before applying cyantraniliprole. For optimum control of thrips, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

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[1] Maintain a spray water pH of 6 or greater.

[2] This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

HERBS

angelica, basil, cilantro, chervil (dried), chives, dillweed, lavender, lemon balm, marjoram (sweet), oregano, parsley, rosemary, sage, savory (summer and winter), tarragon and thyme

In this section:

Table 3-69. Herb Crop Subgroup 19A Seed Treatments
Table 3-70. Herb Crop Subgroup 19A Disease Control
Table 3-71. Herb Crop Subgroup 19A Insect Control
Table 3-72. Fresh Parsley Seed Treatments
Table 3-73. Fresh Parsley Disease Control
Table 3-74. Fresh Parsley Insect Control — Aphids
Table 3-75. Fresh Parsley Insect Control — Cutworms, Tarnished Plant Bug, Leafhoppers
Table 3-76. Fresh Parsley Insect Control — Dipteran Leafminers, Cabbage Looper
Table 3-77. Fresh Chive Leaves Disease Control
Table 3-78. Fresh Chive Leaves Insect Control
Table 3-79. Mint Disease and Insect Control

Herbs grown fall into different crop groups for the purpose of registering pest control products, consequently different herbs have different lists of registered products.

Herb Crop Subgroup 19A

Crop Subgroup 19A, the Herb subgroup of Crop Group 19, *Herbs and Spices,* includes many, but not all, common culinary herbs, including:

- angelica
- balm (lemon balm)
- basil
- cilantro
- chervil (dried)
- dillweed
- lavender
- marjoram (*Origanum* spp., including sweet marjoram and oregano)
- dried parsley
- rosemary
- sage
- savory (summer and winter)
- tarragon
- thyme

This partial list of the crops included in Crop Subgroup 19A is current as of January 2014. Crop Group 19A is currently being reviewed and updated by the Pest Management Regulatory Agency, and this list is expected to change in the near future. For a current, complete list of crops included in Crop Group 19, see the PMRA website at www.hc-sc.gc.ca/cps-spc/pest/part/protect-proteger/food-nourriture/rccg-gcpcr-eng.php.

This information is intended as a guideline only. See product labels for complete information.

Table 3–69. Herb Crop Subgroup 19A Seed Treatments

For resistance management, rotate between fungicides from different chemical groups.

Trade Name	Active ingredients	Rate	Pests Controlled	Notes
Maxim 480FS	fludioxonil	5.2–10.4 mL/100 kg seed	Seed decay, damping-off and seedling blights	**For use by commercial seed treaters only. Basil, cilantro, chervil (dried), dillweed, lavender, marjoram, parsley (dried), rosemary, sage, tarragon and thyme.**

Table 3–70. Herb Crop Subgroup 19A Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL					
microbial (group 44)	*Gliocladium catenulatum*	Prestop	100 g/20 L water (0.5% solution)	—	**Basil, dill, oregano, thyme only. Greenhouse use only. Suppression only.** Suppresses damping-off caused by *Pythium* spp. and *Rhizoctonia solani*, pythium crown and root rot and botrytis gray mold, depending on application method and stage. Suppresses *Fusarium oxysporum* root and stem wilt of basil only. Mix and apply according to product label. 4-hr rentry for foliar applications.
microbial (group 44)	*Bacillus subtilis* strain QST 713	Cease Biological	1–2 L/100 L water	0	**Balm, basil, chervil (dried), coriander, dill, lavender, parsley (dried), rosemary, sage, savory, thyme. Suppression of botrytis gray mold and sclerotinia white mould. Greenhouse use only.** Begin when greenhouse conditions are conducive to disease development.
not classified	potassium bicarbonate	MilStop	0.28–0.56 kg/ 1,000 m^2	0	**Suppression of powdery mildew.** Not all herbs or herb varieties have been tested for phytotoxicity. Start at first sign of disease. Use higher rate when disease pressure is moderate to high. Maximum 10 applications/season. 4-hr re-entry interval.
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	0.2–0.22 L/ha (0.08–0.09 L/acre)	0	**For control of downy mildew on basil only.** Use higher rate and shorter spray interval when disease pressure is moderate to high. Do not make sequential applications. For information on emergency use registrations of alternative fungicides, contact an OMAF specialist or the Agricultural Information Contact Centre (see Appendix A). Tank-mix with a surfactant. See label for details. Maximum 4 applications/season. 12-hr re-entry interval.
POWDERY MILDEW					
not classified	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.2 kg/acre)	0	**Suppression of powdery mildew only.** Apply as described for greenhouse transplants. 4-hr re-entry interval.
BASIL DOWNY MILDEW					
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	0.2–0.22 L/ha (0.08–0.09 L/acre)	0	**Basil only.** Use higher rate and shorter spray interval when disease pressure is moderate to high. Tank-mix with a surfactant. See label for details. Do not make sequential applications. Maximum 4 applications/season. 12-hr re-entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha (1.2–2 L/acre)	1	**Basil only. Suppression only.** Use higher rate and shorter spray interval when disease pressure is high. Maximum 6 applications/season.

Table 3–71. Herb Crop Subgroup 19A Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT INSECT CONTROL					
not classified	*Beauveria bassiana*	BotaniGard ES	0.5–1 L/400 L spray volume (aphids, whitefly) 2 L/400 L spray volume (thrips)	0	**Greenhouse use only.** Apply early in pest infestation. Use shorter spray intervals for heavy infestations. Control may not be apparent for 7–10 days. Do not tank-mix with any other product. May cause injury on some varieties — test on a small area before use on a new variety of plant. 4-hr re-entry interval.
APHIDS — SOIL TREATMENTS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row	14	**Aphids only.** Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a soil application. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. Maximum 1 application/season as a soil application. 24-hr re-entry interval.
APHIDS, SPIDER MITES — FOLIAR TREATMENTS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (80 mL/acre)	7	Aphids. Also provides suppression of leafhoppers. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a soil application. Do not apply immediately prior to bud opening or during bloom. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
soap/ pyrethroid (group 3A)	potassium salts of fatty acids/ pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	**Reduction in populations.** Apply in 100 L of water. Repeat as required, according to application intervals specified on label.
soap	potassium salts of fatty acids	Opal Insecticidal Soap	8 L in 400 L of water. Apply dilute solution at a rate of 700–1,900 L/ha.	0	Applying more than 3 times may cause plant injury.
CABBAGE LOOPER					
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	275–550 g/ha (110–220 g/acre)	0	Apply to small larvae. Use higher rate for higher infestations or larger plants. Maximum 5 applications/yr.
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	

Parsley (fresh)

Fresh parsley falls under Crop Group 4, *Leafy Vegetables (Except Brassica) Group,* and subgroup 4A, *Leafy Greens Subgroup.*

Table 3–72. Fresh Parsley Seed Treatments

Trade Name	Active ingredients	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S	20–40 mL/100 kg seed	damping-off (*Pythium*)	Do not apply to parsley seed destined to be grown in the greenhouse — label treated seed accordingly.
Dynasty 100FS	azoxystrobin	25–50 mL/100 kg seed	damping-off (*Rhizoctonia solani*)	**For import use only.** Not for domestic commercial or on-farm treatment. See label for replant restrictions.

Table 3–73. Fresh Parsley Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL					
microbial (group 44)	*Gliocladium catenulatum*	Prestop	100 g/20 L water (0.5% solution)	—	**Greenhouse use only. Suppression only** of damping-off caused by *Pythium* spp. and *Rhizoctonia solani*, pythium crown and root rot and botrytis gray mold, depending on application method and stage. Mix and apply according to product label 4-hr re-entry interval for foliar applications.
BOTRYTIS GRAY MOLD, SCLEROTINIA WHITE MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	**Suppression only for Sclerotinia, control for Botrytis.** Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade MAX	1–3 kg/ha (0.4–1.2 kg/acre)	0	**Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development.

Table 3–74. Fresh Parsley Insect Control — Aphids

Some insecticides should not be applied to flowering crops when bees are working.
For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil or Transplant Treatments					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	10.2 mL/1,000 plants	21	Transplant tray plug drench. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. Maximum 1 application/season. 24-hr re-entry interval.
			6 mL/100 m of row (1.8 mL/100 ft of row)	21	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. Maximum 1 application/season. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Soil application at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. Maximum 625 mL/ha/yr. 12-hr re-entry interval.
Foliar Treatments					
organophosphate (group 1B)	malathion	Malathion 85E	1.1–1.345 L/ha (0.4–0.5 L/acre)	20	Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (22–34 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (80 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or until residues have dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (77 g/acre)	14	Do not apply through irrigation equipment. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–64 g/acre)	0	Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (88–146 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Label directions require a tank mix with a specified spray adjuvant/additive. See label for further details. See label for recropping restrictions. Do not apply more than 730 mL/ha/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (200–600 mL/acre)	1	Use high rate under heavy pest pressure. Apply with an adjuvant for optimum control — see label for details. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–75. Fresh Parsley Insect Control — Cutworms, Tarnished Plant Bug, Leafhoppers

Some insecticides should not be applied to flowering crops when bees are working.
For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (100 mL/acre)	1	Black cutworms. Apply to small plants, when no rain is forecast in the next 24 hr. Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	1	Apply to small plants, when no rain is forecast in the next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
TARNISHED PLANT BUG					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (84 g/acre)	7	Reduction in damage. Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 12-hr re-entry interval.
LEAFHOPPERS					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	21	Use lower rate on young plants.
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Soil application at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (80 mL/acre)	7	Foliar application. **Suppression only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	Aster leafhopper. For early applications, use the higher rate per 500 L water. Surround WP forms a barrier film, which acts as a broad spectrum protectant that may decrease damage from aster leafhoppers.

Table 3–76. Fresh Parsley Insect Control — Dipteran Leafminers, Cabbage Looper

Some insecticides should not be applied to flowering crops when bees are working.
For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DIPTERAN LEAFMINERS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (34 g/acre)	7	**Pea leafminer only. Reduction in damage only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Soil application at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a plug treatment or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g in 200 L water/ha (75 g in 18 gal water/acre)	7	**Pea leafminer only.** See label for rotational crop restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.40–0.6 L/acre)	1	Use high rate under heavy pest pressure. Apply with an adjuvant for optimum control — see label for details. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
CABBAGE LOOPER					
spinosyn (group 5)	spinosad	Success	182 mL/ha (73 mL/acre)	1	Maintain a spray pH of 6 or greater. Maximum 3 applications/season. Re-entry permitted when residues are dry.
		Entrust	364 mL/ha (146 mL/acre)	1	Maintain a spray pH of 6 or greater. Maximum 3 applications/season. Re-entry permitted when residues are dry.
	spinetoram	Delegate WG	140–200 g/ha (56–80 g/acre)	1	Use high rate for heavy infestations or large larvae. Maximum 3 applications/yr. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	275 g/ha (110 g/acre)	0	No additional information.
		Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	No additional information.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	0.3–0.6 L/ha (0.1–0.2 L/acre)	1	Use high rate for heavy infestations, advanced pest growth stages or larger crops. Do not exceed 2 L product/ha/year. See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (100 mL/acre)	1	Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (100–200 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.

Chives

Fresh chives were originally in the Herb Group but have recently been transferred to Crop Group 3-07, *Bulb Vegetables Group,* and subgroup 3-07B, *Green Onion Subgroup.* Note that Group 3-07 is a new group and that products registered only on the old Crop Group 3 cannot be applied to chives.

Table 3–77. Fresh Chive Leaves Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–6 kg/ha (1.2–2.4 kg/acre)	0	**Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	See label for recropping restrictions. Maximum 3 applications/ season. 12-hr re-entry interval.
QoI/SDHI (group 11/7)	pyraclostrobin/ boscalid	Pristine WG	1.3 kg/ha (0.5 kg/acre)	7	**Suppression only.** Do not make sequential applications for downy mildew. See label for recropping restrictions. 72-hr re-entry interval for thinning. For other activities, re-entry permitted when residues are dry.
BOTRYTIS LEAF BLIGHT					
anilino-pyrimidine (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Begin applications prior to onset of disease (humid weather, rain or heavy dews). See label for recropping restrictions. Do not apply more than 6 L/ha/season. 24-hr re-entry interval for thinning, otherwise 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–4.5 kg/ha (1.2–1.8 kg/acre)	0	**Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	See label for recropping restrictions. Maximum 3 applications/ season. 12-hr re-entry.
QoI/SDHI (group 11/7)	pyraclostrobin/ boscalid	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not make sequential applications when downy mildew is present. See label for recropping restrictions. Maximum 6 applications/season. 72-hr re-entry interval for thinning, for other activities, re-entry permitted when residues are dry.
PURPLE BLOTCH					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	**Suppression only.** Also suppresses botrytis fleck caused by *Botrytis cinerea*[1]. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Do not apply more than 5.25 L/ha/season. 12-hr re-entry interval.
anilino-pyrimidine (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Begin applications prior to onset of disease (humid weather, rain or heavy dews). Do not apply more than 6 L/ha/season. See label for recropping restrictions. 24-hr re-entry interval for thinning, otherwise 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	**Purple blotch and cladosporium leaf blotch control.** See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval.
QoI/SDHI (group 11/7)	pyraclostrobin/ boscalid	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not make sequential applications when downy mildew is present. See label for recropping restrictions. Maximum 6 applications/season. 72-hr re-entry interval for thinning, for other activities re-entry permitted when residues are dry.
STEMPHYLIUM LEAF BLIGHT					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	**Suppression only.** Make no more than 1 application when targeting this disease. See label for recropping restrictions. 12-hr re-entry interval.
ALLIUM WHITE ROT					
not classified	diallyl disulfide	DADS	10 L/ha (4 L/acre)	—	**Suppression only.** Soil-injected into seed-bed–ready fields at least 6 months before planting. Seal soil immediately after application with mechanical packer. Field must be free of all allium family plants, including volunteers, for 6 months after treatment. Use minimum of 500 L of water/ha.

[1] Botrytis fleck is caused by *Botrytis cinerea,* which is different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–78. Fresh Chive Leaves Insect Control

Some insecticides should not be applied to flowering crops when bees are working.
For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
spinosyn (group 5)	spinosad	Success	218–262 mL/ha (87–105 mL/acre)	3	**Suppression only.** Apply when onion thrips first appear at sufficient pressure and water volume to ensure spray solution penetrates the leaf axils. Use high rate when pressure is high. Maintain a spray water pH of 6 or greater. Maximum 3 applications/yr. Re-entry permitted when residues are dry.
		Entrust 80	131–158 g/ha (52–63 g/acre)		
tetronic and tetramic derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (146 mL/acre)	7	**Reduction in numbers of larvae.** Use only when populations are low. Label directions require a tank mix with a specified spray adjuvant/additive. Maximum 2 applications/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	**Suppression only.** Use only when populations are low. Apply with an adjuvant — see product label for details. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
LEEK MOTH					
spinosyn (group 5)	spinosad	Success	218–262 mL/ha (87–105 mL/acre)	3	**Suppression only.** Apply 1 week after peak pheromone trap capture. Use higher rates when pressure is high and/or insects are in advanced growth stages. Maintain a spray water pH of 6 or greater. Maximum 3 applications/yr. Re-entry permitted when residues are dry.
		Entrust 80	131–158 g/ha (52–63 g/acre)		
biological (group 11)	*Bacillus thuringiensis*	Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	**Suppression only.** Apply 7–10 days after peak pheromone capture.

Mint

Mint is not currently included in any crop group. Only use pest control products registered on mint directly.

Table 3–79. Mint Disease and Insect Control

LEGEND: PHI = Pre-Harvest Interval (in days)

Group	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW, RUST					
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	1 L/ha (0.4 L/acre)	7	Begin applications when plants are 5–10 cm (2–4 in.) high or conditions favour disease development. Maximum 2 applications/season. 12-hr re-entry interval.
CABBAGE LOOPER					
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	275–550 g/ha (110–220 g/acre)	0	Apply to small larvae. Use higher rate for higher infestations or larger plants. Maximum 5 applications/yr.
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	

HORSERADISH

In this section:

Table 3-80.	Activity of Fungicides and Insecticides on Horseradish Diseases and Insects
Table 3-81.	Horseradish Disease Control
Table 3-82.	Horseradish Insect Control — Aphids, Flea Beetles
Table 3-83.	Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms, Swede Midge, European Chafer Grubs

This information is provided as a guideline only. See product labels for complete information.

Table 3–80. Activity of Fungicides and Insecticides on Horseradish Diseases and Insects

LEGEND: C = control
RD = reduction in damage
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Alternaria	Cercospora	Powdery Mildew	Botrytis Gray Mold	Rhizoctonia	Aphids	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	European Chafer Grubs	Swede Midge
Fungicides												
pyraclostrobin	Cabrio EG	C	C	C	—	—	—	—	—	—	—	—
trifloxystrobin	Flint	C	—	—	—	—	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	C	—	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	C	—	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—	—	—	—	—	—
Insecticides												
imidacloprid	Admire 240 F	—	—	—	—	—	C	C	—	—	RD	—
thiamethoxam	Actara 25WG	—	—	—	—	—	C	—	—	—	—	—
sulfoxaflor	Closer	—	—	—	—	—	C	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	—	—	—	C	—	—	—	—	—
carbaryl	Sevin XLR	—	—	—	—	—	—	C	C[1]	—	—	—
permethrin	Pounce 384EC	—	—	—	—	—	—	C	—	—	—	—
	Perm-UP	—	—	—	—	—	—	C	—	—	—	—
	Ambush 500EC	—	—	—	—	—	—	C	—	—	—	—
spinosad	Success	—	—	—	—	—	—	—	C	—	—	—
	Entrust	—	—	—	—	—	—	—	C	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	—	C	C	—	C

[1] For control of imported cabbageworm and diamondback moth only.

Table 3–81. Horseradish Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, CERCOSPORA					
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Apply no more than 2 sequential applications. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (57–85 g/acre)	7	**Alternaria only.** Use higher rate and shorter interval when disease pressure is high. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
phenylpyrrole/ anilino-pyramidine (group 12/9)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Use high rate for heavy disease pressure. See label for recropping restrictions. 12-hr re-entry interval.
RHIZOCTONIA — ROOT ROT, CROWN ROT, STEM CANKER					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	One application/yr, applied in-furrow at planting or banded soon after emergence. See label for recropping restrictions. 12-hr re-entry interval.

Table 3–82. Horseradish Insect Control — Aphids, Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Thorough spray coverage is essential for optimum control. Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	No additional notes.
pyrethroid (group 3A)	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	2	12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140 mL/ha (57 mL/acre)	2	
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

Table 3–83. Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms, Swede Midge, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF-EATING CATERPILLARS (IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH)					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	**Imported cabbage worm and diamondback moth only.**
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	3	Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	3	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	Use the higher rate for high infestations or advanced growth stages of the target pest. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250 mL/ha (101 mL/acre)	1	Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	When possible, rotate with other products registered for Swede midge control, otherwise avoid sequential applications for resistance management. 12-hr re-entry interval.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

LETTUCE AND ENDIVE

For information on parsley, see *Herbs*, on page 99.

In this section:

Table 3-84. Lettuce and Endive Seed Treatments
Table 3-85. Activity of Fungicides on Lettuce and Endive Diseases
Table 3-86. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Mold, Lettuce Drop
Table 3-87. Lettuce and Endive Disease Control — Downy Mildew
Table 3-88. Activity of Insecticides on Lettuce and Endive Insects
Table 3-89. Lettuce and Endive Insect Control — Aphids
Table 3-90. Lettuce and Endive Insect Control — Cutworms, Tarnished Plant Bug
Table 3-91. Lettuce and Endive Insect Control — Leafhoppers
Table 3-92. Lettuce and Endive Insect Control — Leafminers
Table 3-93. Lettuce and Endive Insect Control — Cabbage Looper, Brown Marmorated Stink Bug

This information is provided as a guideline only. See product labels for complete information.
Listed products are not necessarily registered on head lettuce, leaf lettuce and/or endive.
See the most up-to-date product label to ensure registration on a specific crop.

Table 3–84. Lettuce and Endive Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S	Ridomil Gold 1G	25 kg/treated ha (10 kg/treated acre)	damping-off (*Pythium*)	**For use on head lettuce only.** Apply with seed in-furrow. Use 115 g/100 m of row. Do not use on transplants.
		Apron XL LS	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	Head and leaf lettuce and endive.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	damping-off (*Rhizoctonia solani*)	Head and leaf lettuce and endive. **For import use only.** Not for domestic commercial or on-farm treatment.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg of seed	seed decay, seedling blight, damping-off	**Lettuce only.** Seed box treatment.

Table 3–85. Activity of Fungicides on Lettuce and Endive Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off/ Root Rot	Botrytis Gray Mold	Downy Mildew	Lettuce Drop	Powdery Mildew
cyazofamid	Ranman 400SC	C	—	S	—	—
	Torrent 400SC	C	—	S	—	—
ferbam	Ferbam 76 WDG	—	C	—	—	—
iprodione	Rovral	—	C	—	—	—
boscalid	Cantus WDG	—	C	—	S	—
penthiopyrad	Fontelis	C	—	—	S	—
Bacillus subtilis	Serenade ASO	—	S	S	S	S
	Serenade Max	—	S	S	S	S
Trichoderma harzianum	Rootshield HC	—	S	—	—	—
metalaxyl-M and S/mancozeb	Ridomil Gold MZ 68WG	—	—	C	—	—
fosetyl-AL	Aliette WDG	—	—	C	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	—	C	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	S	—	—
fluopicolide + fosetyl-AL	Presidio + Aliette WDG	—	—	C	—	—
mandipropamid	Revus	—	—	C	—	—
dimethomorph	Acrobat 50 WP	—	—	S	—	—
ametoctradin/dimethomorph	Zampro	—	—	C	—	—
dicloran	Botran 75W	—	—	—	C	—
Coniothyrium minitans	Contans WG	—	—	—	S	—
quinoxyfen	Quintec	—	—	—	—	C

Table 3–86. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DAMPING-OFF/ROOT ROT (*Pythium* spp.)					
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	30 mL/100 L water	40	For use on greenhouse lettuce transplants for field production. Make a single application as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not use any surfactant with drench applications. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
Greenhouse-Grown Seedlings					
dithiocarbamate (group M3)	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	—	**Lettuce only.** Spray seedlings before transplant.
Field Application					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg/ha (0.6 kg/acre)	4	**Lettuce only.** Start after thinning, apply at 7-day intervals. Maximum 4 applications/yr. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	285 g/ha (115 g/acre)	14	**Head and leaf lettuce only.** See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Head and leaf lettuce and endive. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–12 L/ha (1.6–4.8 L/acre)	0	Lettuce and endive. **Suppression only.**
not classified	*Trichoderma harzianum*	Rootshield HC	10 g/1 L water	—	**Lettuce only. Suppression only.** Use quantity of spray solution to cover foliage. See label for details.
LETTUCE DROP (SCLEROTINIA WHITE MOLD)					
SDHI (group 7)	boscalid	Cantus WDG	385 g/ha (156 g/acre)	14	**Head and leaf lettuce only. Suppression only.** See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Head and leaf lettuce and endive. **Suppression only.** Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.
aromatic hydrocarbons (group 14)	dicloran	Botran 75W	2.3–3.75 kg/ha (0.9–1.5 kg/acre)	14	**Lettuce only.** Maximum 2 applications/yr. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	1–3 kg/ha (0.4–1.2 kg/acre)	0	Lettuce and endive. **Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development.
not classified	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Lettuce only. Suppression only.** Broadcast application, lightly incorporated. Apply to soil prior to or at planting or at time of transplant at least 3 months prior to typical onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details.

Table 3–87. Lettuce and Endive Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	**Common Name**	**Trade Name**	**Rate**	**PHI**	**Notes**
DOWNY MILDEW					
phenylamide/ dithiocarbamate (group 4/M3)	metalaxyl-M and S/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	14	**Head lettuce only.** Maximum 3 applications/ season. 24-hr re-entry interval.
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	200 mL/ha (81 mL/acre)	0	**Head and leaf lettuce only. Suppression only.** Make first application after seeding/ transplanting and the second application when disease appears or when conditions are conducive for disease development. Tank-mix with non-ionic or organosilicone surfactant. See label for application details. See label for recropping restrictions. Maximum 6 applications/crop/yr. 12-hr re-entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	**Lettuce only.** Maximum 5 applications/yr. 12-hr re-entry interval.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	0	Head and leaf lettuce and endive. Preventive control. Begin applications preventively when conditions favour disease development. Maximum 7 applications/yr. 12-hr re-entry interval.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–7 L/ha (1.2–2.8 L/acre)	1	Lettuce and endive. **Suppression only.** Begin applications when conditions are favourable to disease development. Use higher rate and shorter spray interval when disease pressure is high. Maximum 6 applications/season. 12-hr re-entry interval.
benzamide + phosphonate (group 43 + 33)	fluopicolide + fosetyl-AL	Presidio + Aliette WDG	220–292 mL/ha + 2.8 kg/ha (89–118 mL/acre + 1.1 kg/acre)	7	**Lettuce only.** Do not make sequential applications. See label for rotational crop restrictions. 12-hr re-entry interval.
carboxylic acid amide (group 40)	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	**Head and leaf lettuce only.** Use a non-ionic adjuvant (0.25% v/v) as per label directions. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	**Head and leaf lettuce only. Suppression only.** Tank-mix with another fungicide with activity against downy mildew. See label for recropping restrictions. Maximum 5 applications/season. 2-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Head and leaf lettuce and endive. Begin applications prior to disease development. Do not apply with adjuvant. See label for recropping restrictions. Maximum 3 applications/season. 1-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–6 kg/ha (1.2–2.4 kg/acre)	0	**Lettuce only. Suppression only.** Begin applications at the first sign of disease or when conditions favour disease development. Also registered for powdery mildew.

Table 3–88. Activity of Insecticides on Lettuce and Endive Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Cutworms	Tarnished Plant Bug	Leafhoppers	Aster Leafhopper	Cabbage Looper	Leafminers	Brown Marmorated Stink Bug
imidacloprid	Alias 240 SC	C	—	—	—	—	—	—	—
	Grapple$_2$	C	—	—	—	—	—	—	—
	Admire 240 F	C	—	—	S	—	—	—	—
thiamethoxam	Actara 240SC	C	—	—	C	—	—	C[1]	—
acephate	Orthene 75 SP	C	—	—	—	—	C	—	—
dimethoate	Cygon 480	C	—	—	C	—	—	—	—
	Lagon 480 E	C	—	—	C	—	—	—	—
naled	Dibrom	N	—	—	—	—	C	—	—
endosulfan	Thionex 50W WSP	C	—	—	—	—	C	—	—
acetamiprid	Assail 70 WP	C	—	—	—	—	—	RD[2]	—
thiamethoxam	Actara 25WG	C	—	RD	—	—	—	—	—
pymetrozine	Fulfill 50WG	C	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—
sulfoxaflor	Closer	C	—	—	—	—	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—
cyantraniliprole	Exirel	C	C	—	—	—	C	C[1]	—
lambda-cyhalothrin	Matador 120EC	—	C	C	—	—	C	—	—
	Silencer 120 EC	—	C	C	—	—	C	—	—
cypermethrin	Ripcord 400 EC	—	C	—	—	C	—	—	—
	UP-Cyde 2.5 EC	—	—	—	—	C	—	—	—
permethrin	Pounce 384EC	—	C	—	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—	—
	Ambush 500EC	—	C	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	C	—	—	—	C	C[3]	—
carbaryl	Sevin XLR	—	—	C	C	C	—	—	—
malathion	Malathion 85E	C	—	—	C	—	C	—	S
kaolin clay	Surround WP	—	—	—	—	RD	—	—	—
cyromazine	Citation 75WP	—	—	—	—	—	—	C[2]	—
methomyl	Lannate TNG	—	—	—	—	—	C	—	—
spinosad	Success	—	—	—	—	—	C	—	—
	Entrust	—	—	—	—	—	C	—	—
spinetoram	Delegate WG	—	—	—	—	—	C	—	—
Bacillus thuringiensis	Dipel 2X DF	—	—	—	—	—	C	—	—
	Thuricide-HPC	—	—	—	—	—	C	—	—
	Bioprotec CAF	—	—	—	—	—	C	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—

[1] Dipteran leafminers.

[2] Pea leafminer only.

[3] Vegetable & serpentine leafminers only.

Table 3–89. Lettuce and Endive Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
At-Planting Treatments					
neonicotinoid (group 4A)	imidacloprid	Alias 240 SC	10.2 mL/1,000 plants	21	Transplant tray plug drench. **Head and leaf lettuce only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. Gloves must be worn at transplanting.
		Grapple[2]			
		Admire 240 F	10.2 mL/1,000 plants	21	Transplant tray plug drench. Head and leaf lettuce and endive. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. Gloves must be worn at transplanting.
		Alias 240 SC	650 mL/ha (263 mL/acre)	21	Soil application (field drench). **Head and leaf lettuce only.** Apply in 2,000 L water/ha (180 gal/acre) directly over the row. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
		Grapple[2]			
		Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	21	Soil application. Head and leaf lettuce and endive. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Soil application at or shortly following seeding or transplanting. Head and leaf lettuce and endive. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

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[1] Control of aphids with naled has been inconsistent in many areas.

Table 3–89. Lettuce and Endive Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Treatments					
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	7	**Head lettuce only.** Maximum 4 applications/season. 24-hr re-entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the re-entry interval.
	dimethoate	Cygon 480 Lagon 480 E	0.7 L/ha (0.3 L/acre)	7	**Leaf lettuce only.** Do not use on head lettuce.
	naled[1]	Dibrom	1.05–1.6 L/ha (0.4–0.65 L/acre)	4	**Lettuce only.** Maximum 2 applications/season. 48-hr re-entry interval.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.75 kg/ha (0.7 kg/acre)	17	**Head lettuce only.** Maximum 2 applications/season. 4-day re-entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Head and leaf lettuce and endive. Also helps reduce damage caused by pea leafminer. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. 12-hr re-entry interval.
	imidacloprid	Alias 240 SC Grapple$_2$	200 mL/ha (81 mL/acre)	7	**Head and leaf lettuce only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
		Admire 240 F	200 mL/ha (81 mL/acre)	7	Head and leaf lettuce and endive. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Head and leaf lettuce and endive. Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	Head and leaf lettuce and endive. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Head and leaf lettuce and endive. Apply when aphids first appear. Do not apply through irrigation equipment. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Head and leaf lettuce and endive. Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Head and leaf lettuce and endive. Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Head and leaf lettuce and endive. Use high rate under heavy pest pressure. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

[1] Control of aphids with naled has been inconsistent in many areas.

Table 3–90. Lettuce and Endive Insect Control — Cutworms, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	3	**Head lettuce only. Dark-sided and white cutworms only.** Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC			
	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	21	**Lettuce only.** Do not disturb soil for 5 days after treating.
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	**Lettuce only.** Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140–300 mL/ha (57–121 mL/acre)		
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Black cutworms. Apply to small plants, when no rain is forecast in next 24 hr. Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Head and leaf lettuce and endive. Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	5	**Head lettuce only.**
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	3	**Head and leaf lettuce only.** Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC			
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	7	Head and leaf lettuce and endive. **Reduction in damage only.** Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 12-hr re-entry interval.

Table 3–91. Lettuce and Endive Insect Control — Leafhoppers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	5	**Head lettuce only.** Leafhoppers and aster leafhoppers.
				21	Leaf lettuce, endive. Leafhoppers and aster leafhoppers.
organophosphate (group 1B)	malathion	Malathion 85E	735–1,345 mL/ha (297–544 mL/acre)	14	**Leaf lettuce only.** Aster leafhoppers.
				3	**Head lettuce only.** Aster leafhoppers.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	125 mL/ha (51 mL/acre)	14	**Lettuce only.** Aster leafhoppers. Maximum 4 applications/season. 12-hr re-entry interval.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	14	
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Soil application at or shortly following seeding or transplanting. Head and leaf lettuce and endive. Leafhoppers. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Foliar application. Head and leaf lettuce and endive. **Suppression of leafhoppers only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 foliar applications/season. 24-hr re-entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	**Lettuce only.** For early applications, use the higher rate per 500 L water. Surround WP forms a barrier film, which acts as a broad spectrum protectant that may decrease damage from aster leafhoppers.

Table 3–92. Lettuce and Endive Insect Control — Leafminers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	Head and leaf lettuce and endive. **Reduction in damage caused by pea leafminer only.** Do not apply more than once every 7 days. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Head and leaf lettuce and endive. Dipteran leafminers. Also suppresses early-season flea beetles. Soil application at or shortly following seeding or transplanting. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g in 200 L water/ha (76 g in 18 gal water/acre)	7	Head and leaf lettuce and endive. **Pea leafminer only.** See label for rotational crop restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Head and leaf lettuce and endive. Dipteran leafminers. Use high rate under heavy pest pressure. For optimum control of leafminers, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–93. Lettuce and Endive Insect Control — Cabbage Looper, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
carbamate (group 1A)	methomyl	Lannate TNG	0.51–1 kg/ha (0.2–0.4 kg/acre)	7	**Lettuce only.** Maximum 3 applications/yr. 1-day re-entry interval for hand harvest, pruning and thinning. 12-hr re-entry interval for all other activities.
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	7	**Head lettuce only.** Maximum 4 applications/season. 24-hr re-entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the re-entry interval.
	naled	Dibrom	1.05–1.6 L/ha (0.4–0.65 L/acre)	4	**Lettuce only.** Maximum 2 applications/season. 48-hr re-entry interval.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.75 kg/ha (0.7 kg/acre)	17	**Head lettuce only.** Maximum 2 applications/season. 4-day re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	3	**Head lettuce only.** Maximum 3 applications/yr. 24-hr re-entry interval.
		Silencer 120 EC			
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	1	Head and leaf lettuce and endive. Maintain a spray pH of 6 or greater. Maximum 3 applications/season. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	1	
	spinetoram	Delegate WG	140–200 g/ha (57–80 g/acre)	1	Head and leaf lettuce and endive. Use high rate for heavy infestations or large larvae. Maximum 3 applications/yr. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	275–550 g/ha (111–222 g/acre)	0	**Lettuce only.**
		Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Head and leaf lettuce and endive. Apply at first sign of feeding damage or when infestations reach threshold levels as determined by monitoring. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for rotational crop restrictions. Do not exceed 2 L product/ha/year. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Head and leaf lettuce and endive. Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,345 mL/ha (544 mL/acre)	14	**Suppression only. Leaf lettuce only.** Maximum 1 application/season.
				3	**Suppression only. Head lettuce only.** Maximum 1 application/season.

ONIONS, LEEKS AND SHALLOTS

In this section:

Table 3-94. Onion, Leek and Shallot Seed Treatments
Table 3-95. Activity of Fungicides on Onion, Leek and Shallot Diseases
Table 3-96. Onion, Leek and Shallot Disease Control — Botrytis Leaf Blight
Table 3-97. Onion, Leek and Shallot Disease Control — Downy Mildew
Table 3-98. Onion, Leek and Shallot Disease Control — Purple Blotch
Table 3-99. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Allium White Rot, Smut
Table 3-100. Activity of Insecticides on Onion, Leek and Shallot Insects
Table 3-101. Onion, Leek and Shallot Insect Control — Onion Maggot
Table 3-102. Onion, Leek and Shallot Insect Control — Thrips
Table 3-103. Onion, Leek and Shallot Insect Control — Leek Moth, Cutworms

Pest control products listed in these tables are not necessarily registered on all allium crops. This information is provided as a guideline only. See product labels for complete information. See the most up-to-date product label to ensure registration on a specific crop.

Table 3–94. Onion, Leek and Shallot Seed Treatments

LEGEND: RP = registered pest
— = not registered for control of this pest or activity on this pest has not been documented.

Active Ingredient	Trade Name	Rate	Insects and Diseases: Onion Maggot	Insects and Diseases: Damping-Off	Insects and Diseases: Onion Smut	Notes
cyromazine	Governor 75WP	66.7 g/ 1 kg of seed	RP	—	—	**Dry bulb onions and green onions. Imported seed only. For use on muck soils only.** Do not plant treated seed in the same field in consecutive years. See label for rotational crop restrictions. Pre-harvest interval for green onions is 60 days; 100 days for dry onions.
metalaxyl-M and S	Apron XL LS	20 mL/ 100 kg of seed	—	RP	—	**Dry and bunching onions.** Damping-off caused by *Pythium*. **For use in commercial seed-treatment plants only.**
thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	—	RP	—	**Onions only.** Seed box treatment.
carbathiin/thiram	Pro-Gro	25 g/ 1 kg seed	—	—	RP	**Onions only.** Pro-Gro treated seed may be stored for up to 4 months.
azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	—	RP	—	Dry bulb onions, green onions, leeks and shallots. Damping-off caused by *Rhizoctonia*. **For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–95. Activity of Fungicides on Onion, Leek and Shallot Diseases

Listed pest control products are not necessarily registered on all allium crops.
See the most up-to-date labels to ensure registration on your crop of interest.

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient	Trade Name	Onion Smut	Botrytis Leaf Blight	Botrytis Neck Rot	Downy Mildew	Purple Blotch	Stemphylium Leaf Blight	Allium White Rot
mancozeb	Dithane Rainshield	C	C	—	—	—	—	—
	Penncozeb 75 DF Raincoat	—	C	—	—	—	—	—
	Manzate Pro-Stick	—	C	C	C	C	—	—
iprodione	Rovral	—	C	—	C[1]	—	—	—
boscalid	Cantus WDG	—	C	—	—	C	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	S	C	—	—
azoxystrobin/difenoconazole	Quadris Top	—	C	—	C	C	S	—
pyrimethanil	Scala SC	—	C	C	—	C	—	—
pyrimethanil + chlorothalonil	Scala SC + Bravo 500	—	C	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	S	—	—
Bacillus subtilis	Serenade Max	—	S	S	S	—	—	—
chlorothalonil	Bravo 500	—	C	—	—	—	—	—
	Echo 720	—	C	—	—	—	—	—
metalaxyl-M and S/ mancozeb	Ridomil Gold MZ 68WG	—	—	—	C	—	—	—
pyraclostrobin	Cabrio EG	—	—	—	C	C	—	—
fosetyl-AL	Aliette WDG	—	—	—	C	C	—	—
mandipropamid	Revus	—	—	—	C	—	—	—
dimethomorph	Acrobat 50 WP	—	—	—	S	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	C	—	—	—
copper oxychloride	Copper Spray	—	—	—	C	—	—	—
difenoconazole	Inspire	—	—	—	—	C	—	—
penthiopyrad	Fontelis	—	—	—	—	S	—	—
diallyl disulfide	DADS	—	—	—	—	—	—	S
fenamidone	Reason 500SC	—	—	—	S	—	—	—

[1] When tank-mixed with label rates of mancozeb.

Table 3–96. Onion, Leek and Shallot Disease Control — Botrytis Leaf Blight

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg in 300–500 L water/ha (607 g in 30–50 gal water/acre)	15	**Dry bulb onions and leeks only.** Apply on a preventive basis. For leeks, maximum 4 applications/season. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	475 g/ha (192 g/acre)	7	Dry bulb onions, green onions, leeks and shallots. Apply before disease develops. See label for recropping restrictions. Maximum 6 applications/season. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Dry bulb onions, green onions, leeks and shallots. Do not make sequential applications. See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities once spray deposit has dried.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Dry bulb onions, green onions, leeks and shallots. Use high rate and tighter interval if disease pressure is high. See label for recropping restrictions. Maximum 3 applications/season for green onions and leeks. Maximum 4 applications/season for dry bulb onions and shallots. 12-hr re-entry interval.
anilino-pyrimidine (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Dry bulb onions, green onions, leeks and shallots. Also controls botrytis neck rot (*Botrytis allii*). Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. Do not apply more than 6 L/ha/season. 24-hr re-entry interval for hand-thinning. 12-hr re-entry interval for all other activities.
anilino-pyrimidine + chloronitrile (group 9 + M5)	pyrimethanil + chlorothalonil	Scala SC + Bravo 500	1 L/ha + 2.4–4.8 L/ha (0.8 L/acre + 1–1.9 L/acre)	7	**Dry bulb onions only.** Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. 48-hr re-entry interval.
				14	**Green bunching onions only.** Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. 48-hr re-entry interval.
phenylpyrrole/ anilino-pyramidine (group 12/9)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	**Dry bulb onions and green onions only.** See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–4.5 kg/ha (1.2–1.8 kg/acre)	0	**Suppression only.** Onions (all types), leeks and shallots. Also suppresses botrytis neck rot (*Botrytis allii*). Begin applications at the first sign of disease or when conditions favour disease development.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	**Dry onions only.** 24-hr re-entry interval.
		Penncozeb 75 DF Raincoat			
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	**Dry bulb onions only.** 24-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.4–4.8 L/ha (1–1.9 L/acre)	7	**Dry bulb onions only.** Maximum 3 applications/ season. 48-hr re-entry interval.
				14	**Green bunching onions only.** Maximum 5 applications/season. 48-hr re-entry interval.
		Echo 720	1.7–3.3 L/ha (0.7–1.3 L/acre)	7	**Dry bulb onions only.** Maximum 3 applications/ season. 48-hr re-entry interval.
				14	**Green bunching onions only.** Maximum 5 applications/season. 48-hr re-entry interval.

Table 3–97. Onion, Leek and Shallot Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
dicarboximide (group 2)	iprodione	Rovral	0.75 kg in 300–500 L water/ha (0.3 kg in 30–50 gal water/acre)	15	**Dry bulb onions only.** Rovral when tank-mixed with label rates of mancozeb will control downy mildew and botrytis leaf blight. Apply on a preventive basis. This tank-mix combination will help reduce the chance of resistance to Rovral developing. 12-hr re-entry interval.
phenylamide/ dithiocarbamate (group 4/M3)	metalaxyl-M and S/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	7	**Onions only.** Apply before first outbreak of disease. Maximum 3 applications/season. 24-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Dry bulb onions, green onions, leeks and shallots. See label for recropping restrictions. Maximum 3 applications/season for green onions and leeks. Maximum 4 applications/season for dry bulb onions and shallots. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Do not make sequential applications. See label for recropping restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities when spray deposit has dried.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (226–340 g/acre)	7	Onions (all varieties), leeks and shallots. See label for recropping restrictions. Maximum 3 applications/ season. 3-day re-entry for hand-thinning activities. 12-hr re-entry interval for all other activities.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	**Onions only.** Maximum 5 applications/yr. 12-hr re-entry interval.
carboxylic acid amide (group 40)	mandipropamid	Revus	400 mL/ha (161 mL/acre)	7	Dry bulb onions and shallots. Use a non-ionic adjuvant (0.25% v/v) as per label directions. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Tank-mix with another fungicide with activity against downy mildew. See label for recropping restrictions. Maximum 5 applications/ season. 2-day re-entry interval for hand-harvesting green onions and thinning of other crops. 12-hr re-entry interval for all other activities.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Dry bulb onions, green onions, leeks and shallots. Begin applications prior to disease development. The addition of a spreading/penetrating adjuvant is suggested to improve performance. See label for recropping restrictions. Maximum 3 applications/ season. 1-day re-entry interval for hand-harvesting and thinning. 12-hr re-entry interval for all other activities.
microbial (group 44)	*Bacillus subtilis*	Serenade Max	3–6 kg/ha (1.2–2.4 kg/acre)	0	**Suppression only.** Onions (all types), leeks and shallots. Begin applications at the first sign of disease or when conditions favour disease development.
inorganic (group M1)	copper oxychloride	Copper Spray	3 kg/ha (1.2 kg/acre)	1	**Onions only.** Maximum 6 applications/yr. 48-hr re-entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	**Dry bulb onions only.** 24-hr re-entry interval.

Table 3–98. Onion, Leek and Shallot Disease Control — Purple Blotch

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH					
DMI (group 3)	difenoconazole	Inspire	364–512 mL/ha (147–207 mL/acre)	7	Dry bulb onions, green onions, leeks and shallots. See label for recropping restrictions. For green onions, apply no more than 1.53 L/ha/year. For dry bulb onions, apply no more than 2.04 L/ha/year. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Dry bulb onions, green onions, leeks and shallots. See label for recropping restrictions. Maximum 3 applications/season for green onions and leeks. Maximum 4 applications/season for dry bulb onions and shallots. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	475 g/ha (192 g/acre)	7	Dry bulb onions, green onions, leeks and shallots. Apply before disease develops. See label for recropping restrictions. Maximum 6 applications/season. 12-hr re-entry interval.
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Also suppresses botrytis fleck caused by *Botrytis cinerea*[1]. Use higher rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. Do not apply more than 5.25 L/ha/season. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Dry bulb onions, green onions, leeks and shallots. Do not make sequential applications. See label for rotational crop restrictions. Maximum 6 applications/season. 3-day re-entry interval for thinning. Re-entry permitted for all other activities once spray deposit has dried.
anilino-pyrimidine (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Dry bulb onions, green onions, leeks and shallots. Also controls botrytis neck rot (*Botrytis allii*). Begin applications prior to onset of disease particularly if humid weather, rain or heavy dews have been prevalent. See label for recropping restrictions. Do not apply more than 6 L/ha/season. 24-hr re-entry interval for hand-thinning. 12-hr re-entry interval for all other activities.
phenylpyrroles/ anilino-pyramidine (group 12/9)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	**Suppression only. Dry bulb onions and green onions only.** See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (226–340 g/acre)	7	Onions (all varieties), leeks and shallots. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry for hand-thinning activities. 12-hr re-entry interval for all other activities.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	**Onions only.** Maximum 5 applications/yr. 12-hr re-entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	**Dry bulb onions only.** 24-hr re-entry interval.

[1] Botrytis fleck is caused by *Botrytis cinerea*, which is different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–99. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Allium White Rot, Smut

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STEMPHYLIUM LEAF BLIGHT					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Make no more than 1 application when targeting this disease. See label for recropping restrictions. 12-hr re-entry interval.
ALLIUM WHITE ROT					
not classified	diallyl disulfide	DADS	10 L/ha (4 L/acre)	—	**Suppression only.** Soil-injected into seed-bed–ready fields at least 6 months before planting alliums (onions, leeks, shallots). Seal soil immediately after application with mechanical packer. Use minimum of 500 L of water/ha. See label for application details.
SMUT					
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	4.4–8.8 kg/ha (1.8–3.5 kg/acre)	100	**Dry bulb onions only.** Apply in-furrow at seeding time. Use high rate only where smut pressure is high.

Table 3–100. Activity of Insecticides on Onion, Leek and Shallot Insects

Listed pest control products are not necessarily registered on all allium crops.
See the most up-to-date labels to ensure registration on your crop of interest.

LEGEND: C = control
S = suppression
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Onion Maggot Larvae	Onion Maggot Flies	Onion Thrips	Leek Moth	Cutworms
chlorpyrifos	Lorsban 15G	C	—	—	—	—
	Pyrifos 15G	C	—	—	—	—
	Lorsban 4E	C[1]	—	—	—	C
	Lorsban NT	—	—	—	—	C
	Pyrinex 480 EC	—	—	—	—	C
	Nufos 4E	—	—	—	—	C
	Warhawk 480 EC	—	—	—	—	C
diazinon	Diazinon 50WSP	—	C	C	—	—
	Diazinon 500 E	—	C	C	—	—
naled	Dibrom	—	C	C	—	—
lambda-cyhalothrin	Matador 120EC	—	—	N[2]	C	—
	Silencer 120 EC	—	—	N[2]	—	—
cypermethrin	Ripcord 400 EC	—	C	N[2]	—	C
	UP-Cyde 2.5 EC	—	C	N[2]	—	—
deltamethrin	Decis 5 EC	—	—	N[2]	—	—
spinetoram	Delegate WG	—	—	S	S	—
spinosad	Success	—	—	S	S	—
	Entrust 80	—	—	S	S	—
abamectin	Agri-mek 1.9% EC	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—
cyantraniliprole	Exirel	—	—	S	—	—
Bacillus thuringiensis	Bioprotec CAF	—	—	—	S	—
permethrin	Pounce 384EC	—	—	—	—	C
	Perm-UP	—	—	—	—	C
	Ambush 500EC	—	—	—	—	C

[1] Green onions only.

[2] Resistance to these insecticides in onion thrips has been observed in Ontario muck soils.

Table 3–101. Onion, Leek and Shallot Insect Control — Onion Maggot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION MAGGOT					
At-Planting Treatment					
organophosphate (group 1B)	chlorpyrifos	Lorsban 15G	7.9–15.7 kg/ha (3.2–6.3 kg/acre)	109	**Bulb onions only.** See the label for spacing and planter specifications. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
				109	**Dry bulb shallots only.** See label for spacing and planted specifications. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
				97	**Pickling onions only.** See the label for spacing and planter specifications. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Pyrifos 15G	7.9–15.7 kg/ha (3.2–6.3 kg/acre)	109	**Dry onions only.** See the label for spacing and planter specifications. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
				97	**Pickling onions only.** See the label for spacing and planter specifications. See label for recropping restrictions. 24-hr re-entry interval.
		Lorsban 4E	150 mL/1,000 m of row using 800 L of water/ha At 30–38-cm row spacing: 3.9–4.9 L of product/ha (1.6–1.9 L product/acre)	30	**Green onions only.** Apply at time of set planting or 7–10 days after seeding as drench banded over row. See label for recropping restrictions. Maximum 1 application/yr.
Foliar Sprays for Onion Maggot Flies					
organophosphate (group 1B)	diazinon	Diazinon 50WSP	1.1 kg/ha (0.4 kg/acre)	10	**Onions only.** 3-day restricted entry interval.
		Diazinon 500 E	1.1 L/ha (0.4 L/acre)	10	**Onions and green onions only.** 3-day re-entry interval.
	naled	Dibrom	530 mL/ha (214 mL/acre)	4	**Bulb onions only.** Maximum 2 applications/season. 48-hr re-entry interval.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	3	**Onions only.** Maximum 3 applications/season.
		UP-Cyde 2.5 EC	280 mL/ha (113 mL/acre)	3	**Onions only.** Maximum 3 applications/season. 12-hr re-entry interval.

Table 3–102. Onion, Leek and Shallot Insect Control — Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
organophosphate (group 1B)	naled	Dibrom	530 mL/ha (214 mL/acre)	4	**Bulb onions only.** Maximum 2 applications/season. 48-hr re-entry interval.
pyrethroid[1] (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL in 500 L water/ha (76 mL in 50 gal water/acre)	14	Dry bulb onions, green onions, leeks and shallots. Maximum 3 applications/yr. 10-day re-entry interval for hand harvest and thinning in green onions. 24-hr re-entry interval for all other activities in green onions. 24-hr re-entry interval for all other crops.
		Silencer 120 EC			
	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	3	**Onions only.** Maximum 3 applications/season.
		UP-Cyde 2.5 EC	280 mL/ha (113 mL/acre)	3	**Onions only.** Apply at 10-day intervals. Maximum 3 applications/season. 12-hr re-entry interval.
	deltamethrin	Decis 5 EC	200 mL/ha (81 mL/acre)	5	**Onions only.** Maximum 1 application/yr.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Apply according to monitoring (when onion thrips first appear or at threshold of 1 thrips/leaf for dry bulb onions) at sufficient pressure and water volume to ensure spray solution penetrates into the leaf axils. Use high rate when pest pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. 12-hr re-entry interval.
	spinosad	Success[2]	218–262 mL/ha (88–106 mL/acre)	3	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Apply according to monitoring (when onion thrips first appear or threshold of 1 thrips/leaf for dry bulb onions) at sufficient pressure and water volume to ensure spray solution penetrates into the leaf axils. Use high rate when pest pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust 80[2]	131–158 g/ha (53–63 g/acre)		
avermectin (group 6)	abamectin	Agri-mek 1.9% EC[3]	600–1,200 mL/ha (243–485 mL/acre)	30	**Dry bulb onions, pearl onions and shallots only.** Apply when onion thrips first appear or at threshold of 1 thrips/leaf for dry bulb onions. Non-ionic spreading and penetrating surfactants used at a rate of 0.25%–0.5% v/v may improve control. Do not use binder or sticker-type surfactants. Follow surfactant label carefully and test a small number of plants before treating a large area.[3] See label for application details. Maximum 3 applications/season. Re-entry permitted once spray deposit has dried.

[1] Resistance to these insecticides has been observed in Ontario muck soils.

[2] Maintain a spray water pH of 6 or greater.

[3] This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

Table 3–102. Onion, Leek and Shallot Insect Control — Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS (cont'd)					
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	3	**Dry bulb onions and shallots.** Apply when thrips are first noticed or according to thresholds for dry bulb onions. Movento should be used during the first half of the season when adult populations are relatively low or building. Reduction in numbers of thrips larvae may take 3–4 days after application. Label directions require a tank mix with a specified spray adjuvant/additive. See label for application details. See label for recropping restrictions. Maximum 2 applications/season with a minimum of 7 days between applications. 12-hr re-entry interval.
				7	**Green onions and leeks.** Apply when thrips are first noticed. Movento should be used during the first half of the season when adult populations are relatively low or building. Reduction in numbers of thrips larvae may take 3–4 days after application. Label directions require a tank mix with a specified spray adjuvant/additive. See label for application details. See label for recropping restrictions. Maximum 2 applications/season with a minimum of 7 days between applications. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Begin applications when thrips populations are low. If thrips populations are high, use a registered insecticide with different mode of action to reduce thrips populations before applying cyantraniliprole. For optimum control of thrips, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

[1] Resistance to these insecticides has been observed in Ontario muck soils.

[2] Maintain a spray water pH of 6 or greater.

[3] This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

Table 3–103. Onion, Leek and Shallot Insect Control — Leek Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	**Common Name**	**Trade Name**	**Rate**	**PHI**	**Notes**
LEEK MOTH					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL in 500 L water/ha (76 mL in 50 gal water/acre)	14	Dry bulb onions, green onions, leeks and shallots. Maximum 3 applications/yr. 10-day re-entry interval for hand harvest and thinning in green onions. 24-hr re-entry interval for all other activities in green onions. 24-hr re-entry interval for all other crops.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Apply 1 week after peak pheromone trap capture. Use higher rates when pest pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. 12-hr re-entry interval.
	spinosad	Success[1]	218–262 mL/ha (88–106 mL/acre)	3	**Suppression only.** Dry bulb onions, green onions, leeks and shallots. Apply 1 week after peak pheromone trap capture. Use higher rates when pest pressure is high and/or insects are in advanced growth stages. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust 80[1]	131–158 g/ha (53–63 g/acre)		
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	**Suppression only.** Onions, green onions, leeks and shallots. Apply 7–10 days after peak pheromone capture.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	2.4–4.8 L/ha (1–1.9 L/acre)	60	**Bulb and pickling onions only.** Apply between 2–5-leaf stage. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E	2.4–4.8 L/ha (1–1.9 L/acre)	60	**Bulb onions only.** Apply between 2–5-leaf stage. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
		Warhawk 480 EC			
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	21	**Onions only.** Do not disturb soil for 5 days after treating.
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	**Onions only.** Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140–300 mL/ha (57–121 mL/acre)		

[1] Maintain a spray water pH of 6 or greater.

PARSNIPS

In this section:

Table 3–104. Parsnip Seed Treatments
Table 3–105. Activity of Fungicides on Parsnip Diseases
Table 3–106. Parsnip Disease Control
Table 3–107. Activity of Insecticides on Parsnip Insects
Table 3–108. Parsnip Insect Control — Carrot Rust Fly, Aphids
Table 3–109. Parsnip Insect Control — Leafhoppers, Cutworms, European Chafer Grubs

This information is provided as a guideline only. See product labels for complete information.

Table 3–104. Parsnip Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**For use in commercial seed-treatment plants only.**
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	damping-off (*Rhizoctonia solani*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–105. Activity of Fungicides on Parsnip Diseases

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off (*Pythium*)	Damping-Off (*Rhizoctonia*)	Phoma Canker	*Alternaria* spp.	Botrytis Gray Mold
metalaxyl-M and S	Apron XL LS	C	—	—	—	—
azoxystrobin	Dynasty 100FS	—	C	—	—	—
chlorothalonil	Bravo 500	—	—	C	—	—
	Echo 720	—	—	C	—	—
trifloxystrobin	Flint	—	—	—	C	—
penthiopyrad	Fontelis	—	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C

Table 3–106. Parsnip Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHOMA CANKER					
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.8 L/ha (1.1 L/acre)	7	48-hr re-entry interval.
		Echo 720	1.9 L/ha (0.76 L/acre)	7	
***ALTERNARIA* SPP.**					
QoI (group 11)	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Use higher rate and shorter spray interval when disease pressure is high. Avoid consecutive applications. When possible, rotate with fungicides with a different mode of action. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
anilino-pyrimidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–107. Activity of Insecticides on Parsnip Insects

LEGEND: C = control
N = registered, but not considered effective, or resistance is documented
S = suppression
RD = reduction in damage
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Carrot Rust Fly Adults	Aphids	Leafhoppers	Aster Leafhopper	Cutworms	European Chafer Grubs
diazinon	Diazinon 500 E	C	C	—	—	—	—
	Diazinon 50WSP	C	C	—	—	—	—
malathion	Malathion 85E	—	N	—	—	—	—
imidacloprid	Admire 240 F	—	C	C or S[1]	—	—	RD
thiamethoxam	Actara 25WG	—	C	—	C	—	—
sulfoxaflor	Closer	—	C	—	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	C	—

[1] Level of control for leafhoppers depends on application method.

Table 3–108. Parsnip Insect Control — Carrot Rust Fly, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CARROT RUST FLY (ADULTS ONLY)					
organophosphate (group 1B)	diazinon	Diazinon 500 E	1.1 L/ha (0.4 L/acre)	10	3-day re-entry interval.
		Diazinon 50WSP	1.1 kg/ha (0.4 kg/acre)	10	3-day restricted entry interval.
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	7	Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers and flea beetles. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Thorough spray coverage is essential for optimum control. Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.

Table 3–109. Parsnip Insect Control — Leafhoppers, Cutworms, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Leafhoppers. Also controls flea beetles. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. **Suppression of leafhoppers only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aster leafhoppers. Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

PEAS

In this section:

Table 3-110. Pea Seed Treatments
Table 3-111. Activity of Fungicides and Insecticides on Pea Diseases and Insects
Table 3-112. Pea Disease Control
Table 3-113. Pea Insect Control

This information is provided as a guideline only. See product labels for complete information.

Table 3–110. Pea Seed Treatments

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

		Insects		Diseases				
Active Ingredient(s)	**Trade Name**	**Seedcorn Maggots**	**Wireworm**	**Ascochyta**[1]	**Pythium**	**Fusarium**	**Rhizoctonia**	**Notes**
Fungicides Only								
metalaxyl-M and S-isomer	Apron XL LS	—	—	—	C	—	—	**For use in seed-treatment plants only.** See the product label for rates.
metalaxyl	Allegiance FL	—	—	—	C	—	—	**Peas for processing only. For use by commercial seed-treaters only.** See the product label for rates.
fludioxonil/metalaxyl-M and S	Apron Maxx RFC	—	—	C	C	C	C	**For use in commercial or on-farm seed-treatment equipment only.** Use 100 mL/100 kg of seed. See label for recropping restrictions.
carbathiin/thiram	Vitaflo	—	—	C	C	C	C	For use in commercial seed-treaters. See the product label for rates. Do not store treated seed.
Trichoderma harzianum	Rootshield HC	—	—	—	S	S	S	Seed box treatment. 60–125 g/50 kg of seed.
thiram	Thiram 75 WP	—	—	—	C	C	C	Seed box treatment. Use 25–35 g/25 kg of seed.
Insecticides Only								
thiamethoxam	Cruiser 5FS[2]	C	C	—	—	—	—	**For use in commercial seed treatment facilities with closed transfer and treatment equipment only.** See product label for rates. Request the high rate of Cruiser for wireworm control and early-season soybean aphids.
Fungicides + Insecticides								
diazinon/captan	Agrox B-2	C	—	—	C	C	C	Seed box or slurry treatment. Use 80 g/25 kg of seed. Do not use on seed previously treated with an insecticide. Plant seeds within 1 month of treatment.
diazinon/captan	Agrox CD	C	—	—	C	C	C	Seed box treatment. Use on seed previously treated with captan or thiram. Use 50 g/25 kg of seed. Do not use on seed previously treated with an insecticide.
thiamethoxam + metalaxyl-M and S/ fludioxonil	Cruiser 5FS[2] + Apron Maxx RFC	C	C	C	C	C	C	**Cruiser 5FS is for use in commercial seed treatment facilities with closed transfer and treatment equipment only.** See the product labels for rates. Request the high rate of Cruiser for wireworm control and early-season soybean aphids. See Apron Maxx RFC label for recropping restrictions.

[1] Seed-borne.

[2] Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–111. Activity of Fungicides and Insecticides on Pea Diseases and Insects

For information on seed decay, root rots and seed insects, see *Table 3-110. Pea Seed Treatments*, page 138.

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Ascochyta (Mycosphaerella) Blight	White Mold (Sclerotinia)	Powdery Mildew	Slugs	Brown Marmorated Stink Bug	Aphids	Cutworms	Western Bean Cutworm
Fungicides									
azoxystrobin/ propiconazole	Quilt	C	—	C	—	—	—	—	—
boscalid	Lance WDG	C	C	—	—	—	—	—	—
penthiopyrad	Fontelis	C	—	—	—	—	—	—	—
pyraclostrobin	Headline EC	C	—	SC	—	—	—	—	—
sulfur	Microthiol Disperss	—	—	C	—	—	—	—	—
Insecticides									
naled	Dibrom	—	—	—	—	—	C	—	—
methomyl	Lannate TNG	—	—	—	—	S	C	—	—
dimethoate	Cygon 480	—	—	—	—	—	C	—	—
	Lagon 480 E	—	—	—	—	—	C	—	—
malathion	Malathion 25W	—	—	—	—	—	N	—	—
	Malathion 85E	—	—	—	—	S	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	C	C
	Silencer 120 EC	—	—	—	—	—	C	C	C
permethrin	Ambush 500EC	—	—	—	—	—	—	C	—
	Perm-UP	—	—	—	—	—	—	C	—
	Pounce 384EC	—	—	—	—	—	—	C	—
acetamiprid	Assail 70 WP	—	—	—	—	—	C	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	C	C
ferric phosphate	Sluggo Professional	—	—	—	C	—	—	—	—

Table 3–112. Pea Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ASCOCHYTA (MYCOSPHAERELLA) BLIGHT					
SDHI (group 7)	boscalid	Lance WDG	420 g/ha (170 g/acre)	7	See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1–1.5 L/ha (0.4–0.6 L/acre)	0	Also controls botrytis gray mold and alternaria blight at rates between 1–2.25 L/ha (0.4–0.9 L/acre). See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	Rotate applications with other fungicide groups. See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	1–1.5 L/ha (0.4–0.6 L/acre)	15	See label for recropping restrictions. 12-hr re-entry interval.
WHITE MOLD (SCLEROTINIA), POWDERY MILDEW					
SDHI (group 7)	boscalid	Lance WDG	560–770 g/ha (227–312 g/acre)	7	White mould. See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	1 L/ha (0.4 L/acre)	15	Powdery mildew. See label for recropping restrictions. 12-hr re-entry interval.
inorganic (group M2)	sulfur	Microthiol Disperss	1.5 kg/ha (0.6 kg/acre)	1	Powdery mildew. 24-hr re-entry interval.

Table 3–113. Pea Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
carbamate (group 1A)	methomyl	Lannate TNG	510 g/ha (206 g/acre)	1	12-hr re-entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	275–425 mL/ha (111–172 mL/acre)	3	Do not feed or graze vines within 21 days of last application.
		Lagon 480 E			
	malathion	Malathion 25W	4.25 kg/ha (1.7 kg/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
	naled	Dibrom	1.05–2.1 L/ha (0.42–0.85 L/acre)	4	**Processing only.** Do not apply when temperature is above 32°C. 48-hr re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83–233 mL/ha (34–94 mL/acre)	7	May also control lygus bugs. Do not feed or graze treated vines. 24-hr re-entry interval.
		Silencer 120 EC	83–233 mL/ha (34–94 mL/acre)	14	
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	7.5 mL/100 m of row (2.3 mL/100 ft of row)	21	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed treatment, in-furrow or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
		Admire 240 F	200 mL/ha (81 mL/acre)	7	Foliar application. Also suppresses leafhoppers. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as a seed trreatment, in-furrow or soil application. See label for rotational crop restrictions. 24-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.
WESTERN BEAN CUTWORM					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83–187 mL/ha (34–76 mL/acre)	7	May also control lygus bugs. Do not feed or graze treated vines. 24-hr re-entry interval.
		Silencer 120 EC		14	
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	12-hr re-entry interval.
CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Apply in the late evening or at night. Do not feed or graze treated vines. 24-hr re-entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	14	
	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	Apply in the late evening or at night. Apply up to 5-leaf stage. Use high rates on dry soils and/or large cutworms. Do not disturb soil for 5 days after treating. 12-hr re-entry interval.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	
		Pounce 384EC			
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	510 g/ha (206 g/acre)	1	**Suppression only.** Apply when insect first appears. 12-hr re-entry interval.
organophosphate (group 1B)	malathion	Malathion 85E	1.1 L/ha (0.45 L/acre)	3	**Suppression only.**

PEPPERS

In this section:

Table 3-114. Pepper Transplant Production Disease and Insect Control (Greenhouse)
Table 3-115. Activity of Fungicides on Pepper Diseases
Table 3-116. Pepper Disease Control — Bacterial Spot, Alternaria, Anthracnose
Table 3-117. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew
Table 3-118. Activity of Insecticides on Pepper Insects
Table 3-119. Pepper Insect Control — Aphids
Table 3-120. Pepper Insect Control — Cutworms, European Corn Borer
Table 3-121. Pepper Insect Control — Mites, Pepper Maggot, Pepper Weevil
Table 3-122. Pepper Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

This information is provided as a guideline only. See product labels for complete information.

Table 3–114. Pepper Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING DISEASE				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg of seed	Seed treatment. **Pythium damping-off. For use in seed treatment plant only.**
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed treatment. **Seed rot, pre-emergence damping-off caused by *Rhizoctonia solani*.** Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting.
phenylpyrrole (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed treatment. **Seed decay, damping-off and seedling blight caused by *Fusarium* and *Rhizoctonia*. For use by commercial seed treaters only.**
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg of seed	Seed treatment. **Seed decay, seedling blight, damping-off.**
Soil Treatments				
QiI (group 21)	cyazofamid	Ranman 400SC	30 mL in 100 L of water/ha	**Pythium damping-off and root rot.** Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. 60-day PHI. 12-hr re-entry interval.
		Torrent 400SC		
not classified	*Trichoderma harzianum*	RootShield Granules	600–750 g/m^3 of loose planting mix or soil	**Suppression only. Root diseases caused by *Pythium, Rhizoctonia, Fusarium*.** 4-hr re-entry interval for greenhouse applications.
		RootShield HC	55–110 g/m^3 of loose planting mix or soil or planting beds	**Suppression only. Root diseases caused by *Pythium, Rhizoctonia, Fusarium*.** Potting mix application or drench. 4-hr re-entry interval.
phthalamide (group M4)	captan	Maestro 80DF	1.25 kg in 1,000 L of water Apply 50–85 L of solution/100 m^2.	Soil drench treatment. **Damping-off, fungus root rot.** 48-hr re-entry interval.
		Supra Captan 80 WDG		
PHYTOPHTHORA BLIGHT, POWDERY MILDEW				
carboxylic acid amide (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	**Phytophthora blight. Suppression only.** Make one application as a drench, immediately before transplanting. 12-hr re-entry interval.
not classified	*Streptomyces lydicus*	Actinovate SP	425 g in 1,100 L of water/ha (172 g in 445 L of water/acre)	**Powdery mildew. Suppression only.** Spray to wet, but avoid runoff. 1-hr re-entry interval.
BACTERIAL DISEASES				
inorganic (group M1)	copper hydroxide	Kocide 2000	3.2 kg/ha (1.3 kg/acre)	**Bacterial spot.** Apply every 5 days, when warranted, to a maximum of 5 applications over a 4-week period prior to transplanting. Apply in low water volumes. 24-hr re-entry interval.
		Coppercide WP	2.25 kg/ha (0.9 kg/acre)	
INSECTS				
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec 3P	0.8 kg in 1,000 L of water Use quantity of spray solution to achieve sufficient coverage.	***Duponchelia fovealis*.** Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary.
not classified	*Beauveria bassiana*	BotaniGard 22WP	250–500 g in 400 L of water Spray to wet, but avoid runoff.	**Whiteflies, aphids.** 4-hr re-entry interval.
			500–1,000 g in 400 L of water Spray to wet, but avoid runoff.	**Thrips.** 4-hr re-entry interval.

Table 3–115. Activity of Fungicides on Pepper Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

		Greenhouse (Transplants)					Field					
Common Name	**Trade Name**	**Bacterial Spot**	**Damping-Off (Seedlings)**	**Phytophthora Blight**	**Powdery Mildew**	**Root Disease**	**Alternaria (Early Blight)**	**Anthracnose**	**Bacterial Spot**	**Botrytis Gray Mold**	**Phytopthora Blight**	**Powdery Mildew**
difenoconazole	Inspire	—	—	—	—	—	C	C	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	—	C	C	—	—	—	C
boscalid	Cantus WDG	—	—	—	—	—	C	—	—	C	—	—
penthiopyrad	Fontelis	—	—	—	—	—	S	—	—	C	—	—
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	—	C	—	C	—	—
pyraclostrobin	Cabrio EG	—	—	—	—	—	C	C	—	—	—	—
cyazofamid	Ranman 400SC	—	C	—	—	C	—	—	—	—	—	—
	Torrent 400SC	—	C	—	—	C	—	—	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	—	S	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	—	—	—	S	—
dimethomorph	Acrobat 50 WP	—	—	—	—	—	—	—	—	—	S	—
mandipropamid	Revus	—	—	S	—	—	—	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	—	—	—	—	S	—
Bacillus subtilis	Serenade ASO	—	—	—	—	—	S	—	S	S	—	S
copper hydroxide	Coppercide WP	C	—	—	—	—	—	—	C	—	—	—
	Kocide 2000	C	—	—	—	—	—	—	C	—	—	—
	Parasol WG	—	—	—	—	—	—	—	C	—	—	—
copper sulphate	Copper 53W	—	—	—	—	—	C	C	—	—	—	—
captan	Maestro 80DF	—	C	—	—	C	—	—	—	—	—	—
	Supra Captan 80 WDG	—	C	—	—	C	—	—	—	—	—	—
potassium bicarbonate	MilStop	—	—	—	C	—	—	—	—	—	—	C
Streptomyces lydicus	Actinovate SP	—	—	—	S	—	—	—	—	—	—	S
Trichoderma harzianum	RootShield Granules	—	—	—	—	S	—	—	—	—	—	—
	RootShield HC	—	—	—	—	S	—	—	—	—	—	—

Table 3–116. Pepper Disease Control — Bacterial Spot, Alternaria, Anthracnose

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BACTERIAL SPOT					
antibiotic (group 24)	kasugamycin	Kasumin 2L	1.2 L/ha (0.5 L/acre)	1	**Suppression only.** Spray volume must be sufficient to provide good coverage of treated foliage. May be tank-mixed with Kocide. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–15 L/ha (1.6-6 L/acre)	0	**Suppression only.** Begin applications soon after transplant. Repeat as necessary on a 7–10-day interval. When conditions are conducive to rapid disease development, use in a rotational program with other bactericides.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25–3.25 kg/ha (0.91–1.32 kg/acre)	1	Apply at 7–14-day intervals.
		Kocide 2000	2.52–3.2 kg/ha (1–1.3 kg/acre)	1	Apply at 7–10-day intervals. 24-hr re-entry interval.
		Parasol WG	2.25–3.25 kg/ha (0.91–1.32 kg/acre)	1	Apply at 7–14-day intervals. 48-hr re-entry interval.
ALTERNARIA, ANTHRACNOSE					
DMI (group 3)	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	0	**Alternaria, anthracnose.** Use high rate for anthracnose control. See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	**Anthracnose, alternaria.** Do not apply until 21 days after transplanting or 35 days after seeding. See label for rotational crop restrictions. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	**Alternaria.** See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	**Alternaria. Suppression only.** See label for rotational crop restrictions. 12-hr re-entry interval.
anilino-pyrimidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	**Anthracnose.** See label for recropping restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	**Alternaria, anthracnose.** See label for recropping restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3.2–6.1 L/acre)	0	**Alternaria. Suppression only.**
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	1	**Alternaria, anthracnose.** 48-hr re-entry interval.

Table 3–117. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	0	See label for rotational crop restrictions. 12-hr re-entry interval.
anilino-pyrimidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–15 L/ha (1.6–6.1 L/acre)	0	**Suppression only.**
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	**Phytophthora foliar blight. Suppression only.** May be applied as foliar sprays or through sprinkler chemigation. 12-hr re-entry interval.
carboxylic acid amide (group 40)	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	**Suppression only.** See label for rotational crop restrictions. 12-hr re-entry interval.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	**Suppression only.** Use of a spreading/penetrating adjuvant may improve performance. See label for recropping restrictions. 12-hr re-entry interval.
POWDERY MILDEW					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting or 35 days after seeding. See label for recropping restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	5–15 L/ha (2.0–6.1 L/acre)	0	**Suppression only.**
not classified	*Streptomyces lydicus*	Actinovate SP	425 g in 1,100 L of water/ha (172 g in 445 L of water/acre)	0	**Suppression only.** Spray to wet, but avoid runoff. 1-hr re-entry interval.
	potassium bicarbonate	MilStop	2.8–5.6 kg in 1,000 L of water/ha (1.1–2.3 kg in 400 L of water/acre)	0	Spray at 7-day intervals. 4-hr re-entry interval.

Table 3–118. Activity of Insecticides on Pepper Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

		Greenhouse (Transplant)		Field									
Common Name	**Trade Name**	*Duponchelia fovealis*	Whitefly, Aphids, Thrips	Aphids	Cutworms (early-season)	European Corn Borer	Flea Beetle	Mites	Pepper Maggot	Pepper Weevil	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug
carbaryl	Sevin XLR	—	—	—	—	C	C	—	—	—	N	—	C
acephate	Orthene 75 SP	—	—	C	—	C	—	—	C	—	—	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	C	—	—	—	—	—	—	—	—
	Nufos 4E	—	—	—	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	—	C	—	—	—	—	—	—	—	—
	Warhawk 480 EC	—	—	—	C	—	—	—	—	—	—	—	—
dimethoate	Cygon 480	—	—	C	—	—	—	—	C	—	—	—	—
	Lagon 480 E	—	—	C	—	—	—	—	C	—	—	—	—
malathion	Malathion 25W	—	—	N	—	—	—	—	—	C	—	—	—
	Malathion 85E	—	—	N	—	—	—	—	C	C	—	S	—
endosulfan	Thionex 50 W WSP	—	—	C	—	—	C	—	C	—	—	—	—
	Thionex EC	—	—	C	—	—	C	—	C	—	—	—	—
deltamethrin	Decis 5 EC	—	—	—	—	C	—	—	—	—	—	—	—
permethrin	Ambush 500EC	—	—	—	C	C	—	—	—	—	—	—	—
	Perm-UP	—	—	—	C	C	—	—	—	—	—	—	—
	Pounce 384EC	—	—	—	C	C	—	—	—	—	—	—	—
acetamiprid	Assail 70 WP	—	—	C	—	—	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	C[1]	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 25WG	—	—	C	—	—	—	—	—	S	C[1]	RD	C[1]
	Actara 240SC	—	—	C	—	—	S	—	—	—	—	—	—
spinosad	Entrust	—	—	—	—	C	—	—	—	—	—	—	—
	Success	—	—	—	—	C	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—	—	—	—	—	—	—
Bacillus thuringiensis	Bioprotec 3P	C	—	—	—	C	—	—	—	—	—	—	—
	Bioprotec CAF	C	—	—	—	C	—	—	—	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	—	C	—	—	—	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	C	—	—	—	—	—	—	—
spiromesifen	Oberon Flowable	—	—	—	—	—	—	C	—	—	—	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	C	—	—	—	—	—	—	—
cyantraniliprole	Exirel	—	—	C	C	C	—	—	—	—	—	—	—
Beauveria bassiana	BotaniGard 22WP	—	C	—	—	—	—	—	—	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	—	—	C	—	—	—	—	—

[1] See label for details.

Table 3–119. Pepper Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Treatment					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
		Actara 25WG	3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
		Actara 240 SC	375–625 mL/ha (152–253 mL/acre)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–119. Pepper Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS (cont'd)					
Foliar Treatment					
organophosphate (group 1B)	acephate	Orthene 75 SP	562 g/ha (228 g/acre)	7	**Sweet bell pepper only.** 24-hr re-entry interval.
	dimethoate	Cygon 480	0.7–1.0 L/ha (0.3–0.4 L/acre)	7	No additional information.
		Lagon 480 E	0.7–1.0 L/ha (0.3–0.4 L/acre)	3	No additional information.
	malathion	Malathion 25W	2.25–5.5 kg/ha (0.91–2.22 kg/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–2.25 kg/ha (0.45–0.91 kg/acre)	27	9-day re-entry interval.
		Thionex EC	1.25–2.5 L/ha (0.51–1.01 L/acre)	27	4-day re-entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Should be tank-mixed with an adjuvant. See label for details. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–120. Pepper Insect Control — Cutworms, European Corn Borer

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	45 mL/100 m of row (14 mL/100 ft of row)	2	Apply in 25–30-cm band over row.
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	40	**Green pepper only.** See label for recropping restrictions. 24-hr re-entry interval.
		Warhawk 480 EC	2.4 L/ha (1 L/acre)	40	**Green pepper only.** Apply as a soil treatment 3–7 days before transplanting. See label for recropping restrictions. 24-hr re-entry interval.
		Warhawk 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)	40	**Green pepper only.** See label for recropping restrictions. 24-hr re-entry interval.
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	1	See label for application instructions. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	1	See label for application instructions. 12-hr re-entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	1	See label for application instructions. Re-entry permitted once spray deposit has dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.
EUROPEAN CORN BORER					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1.0–2.1 L/acre)	2	In areas where corn borer has been a problem, spray every 4 days.
organophosphate (group 1B)	acephate	Orthene 75 SP	825 g/ha (334 g/acre)	7	**Sweet bell pepper only.** 24-hr re-entry interval.
pyrethroid (group 3A)	deltamethrin	Decis 5 EC	250–300 mL/ha (101–121 mL/acre)	3	No additional information.
	permethrin	Ambush 500EC	140 mL/ha (57 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180 mL/ha (73 mL/acre)	1	12-hr re-entry interval.
		Pounce 384EC	180 mL/ha (73 mL/acre)	1	Re-entry permitted once spray deposit has dried.
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Time application to target egg hatch or very small larvae. Maintain a spray water pH of 6 or greater. Re-entry permitted once spray deposit has dried.
		Success	83 mL/ha (34 mL/acre)	1	
biological (group 11)	*Bacillius thuringiensis* subsp. *kurstaki*	Bioprotec CAF	2.8 L/ha (1.1 L/acre)	1	**Sweet pepper only.** Apply to young larvae at first signs of infestation.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	1	Must be absorbed by eggs or ingested by insect larvae. 12-hr re-entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–121. Pepper Insect Control — Mites, Pepper Maggot, Pepper Weevil

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MITES					
tetronic and tetramic acid derivative (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. See label for rotational crop restrictions. 12-hr re-entry interval.
bifenazate (group UN)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr re-entry interval.
PEPPER MAGGOT					
organophosphate (group 1B)	acephate	Orthene 75 SP	562 g/ha (227 g/acre)	7	**Sweet bell pepper only.** 24-hr re-entry interval.
	dimethoate	Cygon 480	0.7–1.0 L/ha (0.28–0.40 L/acre)	7	No additional information.
		Lagon 480 E		3	No additional information.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–2.25 kg/ha (0.45–0.91 kg/acre)	27	9-day re-entry interval.
		Thionex EC	1.5–2.5 L/ha (0.61–1.0 L/acre)	27	4-day re-entry interval.
PEPPER WEEVIL					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	280 g/ha (113 g/acre)	1	**Suppression only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–122. Pepper Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	No additional information.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply 100–200 mL/plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,345 mL/ha (544 mL/acre)	3	**Suppression only.**
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	**Reduction in damage only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	No additional information.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply 100–200 mL/plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

POTATOES

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Table 3–123. Potato Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Diseases or Insects Controlled
Fungicides				
methyl-benzimadazole carbamates (group 1)	thiophanate-methyl	Senator PSPT	500 g/ 100 kg seed	Fusarium seed piece decay and seed-borne Verticillium.
dithiocarbamate (group M3)	mancozeb	Tuberseal	500 g/ 100 kg seed	Fusarium seed piece decay.
		Solan MZ Potato ST Fungicide	500 g/ 100 kg seed	Fusarium seed piece decay.
		PSPT 16%	500 g/ 100 kg seed	Fusarium seed piece decay. Potatoes must be dry when treated with mancozeb. Apply thoroughly to coat the surface of whole or cut seed pieces with dust. Plant as soon as possible after treatment. Do not use surplus treated seed for food or feed.
phenylpyrrole (group 12)	fludioxonil	Maxim PSP[1]	500 g/ 100 kg seed	Fusarium dry rot and seed-borne Rhizoctonia.
		Maxim Liquid PSP[1]	5.2 mL/ 100 kg seed	Fusarium dry rot and seed-borne Rhizoctonia.
phenylpyrrole/ dithiocarbamate (group 12/M3)	fludioxonil/ mancozeb	Maxim MZ PSP[1]	500 g/ 100 kg seed	Fusarium dry rot and seed-borne Rhizoctonia.
phenylpyrrole/DMI (group 12/3)	fludioxonil/ difenoconazole	Maxim D[1]	65–130 mL/ 100 kg seed	Fusarium dry rot. Apply using standard seed treatment equipment that provides uniform seed coverage. Uneven or incomplete seed coverage may not give the desired level of disease control. Do not exceed a maximum slurry volume of 260 mL/100 kg seed. See label for further directions.
			130 mL/ 100 kg seed	Use the high rate to control black scurf, stem and stolon canker (*Rhizoctonia*) and silver scurf.
Insecticides				
neonicotinoid[2] (group 4A)	clothianidin	Titan ST	10.4–20.8 mL/ 100 kg seed	Colorado potato beetle, potato flea beetle, potato leafhopper, aphids.[2] Maximum 1 application/yr. For extended control, use the higher rate.
	imidacloprid	Admire 240 F Alias 240 SC Grapple$_2$	26–39 mL/ 100 kg seed	Colorado potato beetle, potato flea beetle, potato leafhopper, aphids.[2]
	thiamethoxam	Actara 240 SC	Rates based on seed spacing	Colorado potato beetle, potato leafhoppers, aphids.[2] Check label for rate to use. Maximum rate cannot exceed 488 mL/ha or 195 mL/acre.
	clothianidin	Titan ST	20.8 mL/ 100 kg seed	Suppression of wireworms only. Maximum 1 application/yr. Do not dilute with any more than 6 parts water to 1 part Titan ST insecticide. Plant seed pieces as soon as possible after cutting and treating.
diamide (group 28)	cyantraniliprole	Verimark	45 mL/ 100 kg seed	Colorado potato beetle and flea beetle spring adults. Seed piece treatment. Good coverage of the seed-piece is required for optimal control. Following application of Verimark insecticide, application of a fungicide potato seed treatment or inert dust is recommended. See label for information on worker safety protocols. Do not apply any subsequent applications of Group 28 insecticides following a soil or seed piece application. See label for rotational crop restrictions. Maximum 1 soil or seed piece treatment/season. 12-hr re-entry interval.

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[1] Maxim treatments may increase the number of stems, leading to smaller tuber size.

[2] Do not apply a foliar neonicotinoid spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment. See *Caution*, on page 164.

Table 3–123. Potato Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Diseases or Insects Controlled
Insecticide + Fungicide				
neonicotinoid[2] (group 4A) + SDHI/DMI (group 7/3)	clothianidin + penflufen/ prothioconazole	Titan ST + Emesto Silver	10.4–20.8 mL + 20 mL/ 100 kg seed	**Insects** — Colorado potato beetle, potato flea beetle, potato leafhopper, aphids. High rate of Titan ST for suppression of wireworms. **Diseases** — Fusarium tuber rot, seed-borne Rhizoctonia, silver scurf. Maximum 1 application/yr. For extended control, use the higher rate.
Growth Regulator				
carboxilic acid	giberellic acid	Falgro Tablet	1 tablet in 75 L of water (treats 61,000 kg seed)	For increased tuber set and smaller tuber profile for seed, table and processing potatoes.

[1] Maxim treatments may increase the number of stems, leading to smaller tuber size.

[2] Do not apply a foliar neonicotinoid spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment. See *Caution*, on page 164.

Table 3–124. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PYTHIUM LEAK, PINK ROT, RHIZOCTONIA, SILVER SCURF, FUSARIUM DRY ROT					
In-Furrow					
phenylamide (group 4)	metalaxyl-M and S	Ridomil Gold 480 SL	4 mL/100 m of row (1.2 mL/100 ft of row)	80	**Pink rot.** Apply directly over the seed pieces in-furrow.
SDHI (group 7)	penthiopyrad	Vertisan	15.5–31 mL/100 m of row (4.7–9.4 mL/100 ft of row)	7	**Suppression of rhizoctonia stem canker only.** Apply in-furrow at planting in sufficient water volume to obtain uniform application. 12-hr re-entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–2 mL/100 ft of row)	90	**Rhizoctonia stem canker, stolon canker. Suppression of silver scurf.** Apply once at planting in 50–140 L of water/ha (5–14 gal/acre). 30-day plant-back restrictions.
Foliar					
phenylamide/ dithiocarbamate (group 4/M3)	metalaxyl-M/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	3	**Pink rot suppression.** The pythium leak fungus can only penetrate potato tubers through wounds. Metalaxyl-M accumulates in the tuber skin. Tuber wounds allow the *Pythium* fungus to get past the metalaxyl-M barrier and leak develops. Experience has shown that strains of the pink rot pathogen may develop resistance to metalaxyl-M and S isomer. Failure to control the diseases will result in crop damage and/or yield losses in the field or in storage. Early and late blight: Mancozeb, the protectant fungicide in this mixture, should also provide protection against early and late blight. Do not use more than 3 times/year. Provides only erratic suppression of pythium leak.
phenylamide/ chloronitrile (group 4/M5)	metalaxyl-M and S/ chlorothalonil	Ridomil Gold/ Bravo Twin Pak	1 jug/4 ha (1 jug/10 acre)	14	**Pink rot suppression.** Do not use more than 3 times/year. Do not let tank contents stand for prolonged periods of time without agitation. If spraying is interrupted, thoroughly re-agitate before resuming application. Bravo also controls early and late blight and botrytis vine rot. 48-hr re-entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	5.8–11.6 L/ha (2.3–4.6 L/acre)	0	**Suppression of pink rot only.** Use higher rate and shorter interval when disease pressure is moderate to high. May be tank-mixed; see label for list of tank-mix partners. Rotate with fungicides with a different mode of action. Maximum 7 applications/season. 12-hr re-entry interval.

Table 3–124. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PYTHIUM LEAK, PINK ROT, RHIZOCTONIA, SILVER SCURF, FUSARIUM DRY ROT (cont'd)					
Post-Harvest					
dithiocarbamate (group M3)	mancozeb	Dithane F-45	1.58 L/ 1,000 kg of seed	N/A	Apply to seed potatoes only prior to storage to control fusarium dry rot.
inorganic (group M1)	hydrogen peroxide	StorOx	100 mL/ 10 L water	N/A	**Fusarium dry rot suppression only.** Apply prior to storage.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	85–175 mL/ tonne of potatoes	N/A	See product label for details.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	0.42 L in 2 L water for 1 tonne of potatoes	N/A	**Suppression of pink rot.** See product label for details.
				N/A	Control of late blight.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	Dilute at a 1:5.13 ratio with water.	N/A	**Suppression of late blight, pink rot and silver scurf.** Apply 2 L of this solution as a spray to 1,000 kg of potatoes prior to storage.
		Rampart	**Application prior to storage:** 190 mL/1 L water Apply 2 L of this solution as spray or rinse to 1,000 kg of potatoes. **Application to stored potatoes:** 190 mL/1 L of water Inject 2 L of this solution/1,000 kg of tubers in water used for post-harvest storage.	N/A	**Post-harvest suppression of late blight and pink rot.** Apply as soon as possible after harvest. Maximum 1 application/yr, as either single spray or rinse to harvested tubers prior to storage or as a single application through the humidification system in storage.
phenylpyrrole/ DMI/QoI (group 12/3A/11)	fludioxonil/ difenoconazole/ azoxystrobin	Stadium	32.5 mL/tonne dilute in 2 L water/metric tonne	N/A	**Control of fusarium dry rot and suppression of silver scurf. Do not apply to seed potatoes.** Ensure proper coverage of the tubers. Tubers should be rotating along a conveyor line into storage, in a single layer to ensure proper coverage. Do not make more than one post-harvest application to the tubers.

Table 3–125. Potato — Broad Spectrum Protectant Fungicides

Start spraying prior to row closure. For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
chloronitrile (group M5)	chlorothalonil	Bravo 500	1.2–2.4 L/ha (0.5–0.97 L/acre)	1	Late blight control. Use high rate under severe disease pressure. Use higher rates as the crop canopy closes. 48-hr re-entry interval.
			1.6–2.4 L/ha (0.64–0.97 L/acre)		Early blight, botrytis vine rot control.
		Echo 90 DF	0.7–1.3 kg/ha (0.3–0.5 kg/acre)	1	Late blight control.
			0.9–1.3 kg/ha (0.4–0.5 kg/acre)		Early blight and botrytis vine rot control. Use sufficient water to obtain adequate spray coverage. Begin applications when plants are 15–20 cm high, or when disease threatens. Do not use more than 12 applications/season.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Use high rate under severe disease pressure. Use higher rates as the crop canopy closes. 24-hr re-entry interval.
		Dithane Rainshield			
		Penncozeb 75 DF Raincoat			
	metiram	Polyram DF	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	24-hr re-entry interval. Use high rate under severe disease pressure. Use higher rates as the crop canopy closes.

Table 3–126. Potato — Early Blight and Late Blight Protectant Fungicides

Begin applications prior to disease development.
For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EARLY BLIGHT ONLY					
QoI (group 11)	azoxystrobin	Quadris Flowable	500–800 mL/ha (200–320 mL/acre)	1	Maximum 3 applications/yr. Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide.
QoI + chloronitrile (group 11 + M5)	azoxystrobin + chlorothalonil	Quadris Flowable + Bravo 500	500 mL/ha + 2 L/ha (200 mL/acre + 800 mL/acre)	2	Maximum 3 applications/yr. Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. 48-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (226–400 mL/acre)	14	Also suppresses brown spot (*Alternaria alternata*) and black dot (*Colletotrichum coccodes*). Use higher rate and shorter spray interval when disease pressure is high. Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. Rotate with fungicides with a different mode of action. See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval.
SDHI (group 7)	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	**Suppression only.** At the rate of 1.25–1.75 L/ha, Vertisan will control botrytis gray mold. Do not make more than 2 applications before rotating to a different fungicide group. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	450–670 mL/ha (180–268 mL/acre)	3	Rotate with a product from a different fungicide family after every application. 48-hr re-entry interval.
anilino-pyrimidine + chloronitrile (group 9 + M5)	pyrimethanil + chlorothalonil	Scala SC + Bravo 500	750 mL/ha + 1.2–2.4 L/ha (300 mL/acre + 0.5–1 L/acre)	7	Maximum 6 applications/yr. 48-hr re-entry interval.
SDHI/anilino-pyrimidine (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	600 mL/ha (243 mL/acre)	7	Begin fungicide applications preventively, continue on a 7–14-day interval. Application is permitted by air or ground application equipment. Do not make more than 2 sequential applications before rotating with fungicides with different modes of action. Do not apply more than 3.2 L of product/ha/season. 12-hr re-entry interval. Also controls brown leaf spot. Luna Tranquility will control white mold and suppress black dot at a rate of 800 mL/ha.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (70–126 g/acre)	30	Do not apply more than 2 applications before rotating to a different fungicide family. 12-hr re-entry interval.
DMI (group 3)	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	14	Apply no more than 2 sequential applications. Maximum 2.04 L/ha/year. 12-hr re-entry interval.
	metconazole	Quash Fungicide	175–280 g/ha (70–112 g/acre)	1	Apply prior to infection for preventive control. If conditions are favourable for disease development, make additional applications at 7–10-day interval. Do not make more than 2 sequential applications before rotating to a fungicide with different mode of action. Maximum 3 applications at the high rate or 4 applications at the low rate. Do not apply more than 840 g/ha/season. 12-hr re-entry interval for scouting. 2-day re-entry interval for roguing. 7-day re-entry interval for hand set irrigation.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3–6 L/acre)	0	**Suppression only.**

Table 3–126. Potato — Early Blight and Late Blight Protectant Fungicides

Begin applications prior to disease development.
For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	**Common Name**	**Trade Name**	**Rate**	**PHI**	**Notes**
EARLY AND LATE BLIGHT					
QoI + dithiocarbamate (group 11 + M3)	fenamidone + mancozeb	Reason 500 SC + Manzate Pro-Stick	200 mL/ha + 1.25 kg/ha (80 mL/acre + 0.5 kg/acre)	14	Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. See label for recropping restrictions. 24-hr re-entry interval.
		Reason 500 SC + Dithane Rainshield	200 mL/ha + 1.17 kg/ha (80 mL/acre + 0.47 kg/acre)		
		Reason 500 SC + Penncozeb 75 DF Raincoat	200 mL/ha + 1.17 kg/ha (80 mL/acre + 0.47 kg/acre)		
QoI + chloronitrile (group 11 + M5)	fenamidone + chlorothalonil	Reason 500 SC + Bravo 500	200 mL/ha + 1.25 L/ha (80 mL/acre + 500 mL/acre)	14	Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. See label for recropping restrictions. 48-hr re-entry interval.
QoI/ cyanoacetamide oxime (group 11/27)	famoxadone/ cymoxanil	Tanos 50 DF	560–840 g/ha (224–336 g/acre)	14	Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. 24-hr re-entry interval.
QoI + chloronitrile (group 11 + M5)	pyraclostrobin + chlorothalonil	Headline EC + Bravo 500	450–670 mL/ha + 1.2–2.4 L/ha (180–268 mL/acre + 0.5–1 L/acre)	3	Rotate with a product from a different fungicide family after every application. 48-hr re-entry interval.
QoI + dithiocarbamate (group 11 + M3)	pyraclostrobin + metiram	Headline EC + Polyram DF	450–670 mL/ha + 1.1–1.75 kg/ha (180–268 mL/acre + 440–700 g/acre)	3	Rotate with a product from a different fungicide family after every application. 48-hr re-entry interval.
QoI/ dithiocarbamate (group 11/M3)	pyraclostrobin/ metiram	Cabrio Plus	2.25–3.35 kg/ha (0.91–1.35 kg/acre)	3	Do not apply sequential applications of any QoI fungicide or of any tank mix containing a QoI fungicide. 12-hr re-entry interval.

Table 3–127. Potato — Late Blight Targeted Protectant Fungicides

Begin applications when weather conditions favour late blight, or if late blight is identified in the local area.
For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
carbamate/ chloronitrile (group 28/M5)	propamocarb/ chlorothalonil	Tattoo C	2.7 L/ha (1.1 L/acre)	7	Use 200–300 L water/ha (20–30 gal/acre). Maximum 3 applications/yr. 48-hr re-entry interval. 4-hr re-entry interval with protection as specified on label for short-term tasks not involving hand labour.
carboxylic acid amide (group 40)	mandipropamid	Revus	400–600 mL/ha (160–240 mL/acre)	14	Use of a non-ionic adjuvant (0.25% v/v) is suggested. See label for recropping restrictions.
cyanoacetamide oxime + dithiocarbamate (group 27+M3)	cymoxanil + mancozeb	Curzate 60 DF + Manzate Pro-Stick	225 g/ha + 1.6 kg/ha (90 g/acre + 0.65 kg/acre)	8	Make 2 applications, 5 days apart, then rotate with a late blight targeted protectant fungicide from a different chemical group. 24-hr re-entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	400 mL/ha (160 mL/acre)	14	24-hr re-entry interval. Do not make more than 3 sequential applications.
QiI (group 21)	cyazofamid	Ranman 400SC	100–200 mL/ha (40–80 mL/acre)	7	Maximum 6 applications/yr. Do not make sequential applications. 12-hr re-entry interval. 30-day plant-back interval. Use high rate for tuber blight protection.
		Torrent 400SC	100–200 mL/ha (40–80 mL/acre)	7	Maximum 6 applications/yr. Do not make sequential applications. 30-day plant-back interval. Use high rate for tuber blight protection. 12-hr re-entry interval.
benzamide/ dithiocarbamate (group 22/M3)	zoxamide/ mancozeb	Gavel 75 DF	1.7–2.25 kg/ha (0.7–0.9 kg/acre)	3	Maximum 6 applications/yr. Plant-back restrictions apply, see label for details. 48-hr re-entry interval.
benzamide + chloronitrile (group 43 + M5)	fluopicolide + chlorothalonil	Presidio + Bravo 500	220–292 mL/ha + 1.2–2.4 L/ha (91–120 mL/acre + 0.5–1.0 L/acre)	7	Maximum 4 applications/yr. Do not make sequential applications. 48-hr re-entry interval. See label for rotational crop restrictions.
carboxylic acid amide + chloronitrile (group 40 + M5)	dimethomorph + chlorothalonil	Acrobat 50 WP + Bravo 500	450 g/ha + 1.2–2.4 L/ha (180 g/acre + 0.5–1.0 L/acre)	14	Maximum 3 applications/yr. 120-day plant-back interval. Apply after top kill for tuber blight protection. 48-hr re-entry interval.
carboxylic acid amide + dithiocarbamate (group 40 + M3)	dimethomorph + mancozeb	Acrobat 50 WP + Dithane Rainshield	450 g/ha + 1.1–2.25 kg/ha (180 g/acre + 0.4–0.9 kg/acre)	14	No additional information.
	dimethomorph + metiram	Acrobat 50 WP + Polyram DF	450 g/ha + 1.1–2.25 kg/ha (180 g/acre + 0.4–0.9 kg/acre)	14	No additional information.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	0.8–1 L/ha (0.32–0.4 L/acre)	4	Use higher rate when disease pressure is high. The addition of a spreading/penetrating adjuvant may improve disease control. Make no more than 2 sequential applications before alternating to different fungicide groups. Maximum 3 applications/season. See label for plant-back restrictions. 12-hr re-entry interval.

Table 3–127. Potato — Late Blight Targeted Protectant Fungicides

Begin applications when weather conditions favour late blight, or if late blight is identified in the local area.
For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	**Suppression of late blight and pink rot.** Begin applications when conditions are favourable to disease development and continue on a 7–14-day interval. Use higher rate and shorter spray interval when disease pressure is high. Rotate with fungicides with different mode of action. Maximum 5 applications/season. 12-hr re-entry interval. Confine Extra Fungicide should not be used on potatoes intended for seed, as sufficient data does not exist to support this use.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–11.6 L/ha (1.2–4.6 L/acre)	0	Preventive control. Begin applications when conditions favouring disease development exist. Use higher rate and shorter interval when disease pressure is moderate to high. May be tank-mixed; see label for list of tank-mix partners. Rotate with fungicides with a different mode of action. Maximum 7 applications/season. 12-hr re-entry interval.
inorganic (group M1)	copper hydroxide	Kocide 2000	0.8–1.6 kg/ha (0.3–0.6 kg/acre)	1	Combine with 1.75–2.25 kg/ha (0.7–0.9 kg/acre) Manzate Pro-Stick. Use 2.4 kg/ha (1 L/acre) at vine kill. 48-hr re-entry interval.
		Parasol Flowable	0.8–1.8 L/ha (0.32–0.7 L/acre)	1	
		Coppercide WP	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Combine with 1.75–2.25 kg/ha (0.7–0.9 kg/acre) of a mancozeb product. May be applied at vine kill with a dessicant or alone after vine kill, prior to harvest at the rate of 3.4 kg/ha (1.4 kg/acre). 48-hr re-entry interval.
	copper sulphate	Copper 53W	5.5 kg/ha (2.2 kg/acre)	1	Copper sulphate can cause phytotoxicity, especially under hot and humid conditions. Apply close to vine-killing time to kill spores of the late blight fungus.
	copper oxychloride	Copper Spray	4 kg/ha (1.6 kg/acre)	1	No additional information.
QxI/carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	Reduces tuber blight when applied immediately prior to or after vine kill. See label for plant-back restrictions. 12-hr re-entry interval.

Table 3–128. Potato Insect Control — Colorado Potato Beetle

For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
In-Furrow					
neonicotinoid[1] (group 4A)	imidacloprid	Admire 240 F[1]	0.85–1.3 L/ha (0.34–0.53 L/acre)[2]	—	Use 7.5–12 mL/100 m of row. For best results, spray directly on the seed piece.
		Grapple$_2$[1]			
	thiamethoxam	Actara 240 SC[1]	378–488.9 mL/ha (153–197.9 mL/acre)[2]	90	Will also control the potato leafhopper, aphids (including green peach, potato, buckthorn, and foxglove aphid). 12-hr re-entry interval.
	clothianidin	Clutch 50 WDG[1]	266–448 g/ha (108–181 g/acre)	—	No additional information.
		Titan[1]	221–373 mL/ha[2] (89.4–150 mL/acre)[2]	—	Will also control leafhoppers. Maximum 1 application/season. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row or 750–1,000 mL/ha (300–400 mL/acre)[2]	—	Will also control the adult potato flea beetle first generation. Apply as a narrow band in-furrow. For best results, direct spray on the seed pieces in the furrow. Thorough coverage of seed pieces is important to obtain optimum control. See label for information on worker safety protocols. Do not apply any subsequent applications of Group 28 insecticides following a soil or seed piece application. Maximum 1 soil/seed piece treatment/season. 12-hr re-entry interval.
Foliar Sprays					
spinosyn (group 5)	spinetoram	Delegate WG	160–240 g/ha (65–97 g/acre)	7	Time the application for egg hatch or small larvae. Scout fields 3 days after the first application, a repeat application might be necessary. Will also control European corn borer at a rate of 160 g/ha.
	spinosad	Success	166 mL/ha (67 mL/acre)	7	Will also control European corn borer. Maximum 240 mL of product/year. 12-hr re-entry interval.
		Entrust	167–334 mL/ha (68–135 mL/acre)	7	Will also control European corn borer (small larvae) at the rate of 250 mL/ha. Maximum 2 applications/yr. 12-hr re-entry interval.
neonicotinoid[1] (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Maximum 2 foliar applications/yr. 24-hr re-entry interval.
		Grapple$_2$			
	acetamiprid	Assail 70 WP	40–80 g/ha (16–32 g/acre)	7	Maximum 2 applications/yr. 12-hr re-entry interval.
	clothianidin	Clutch 50 WDG	70–105 g/ha (28–42 g/acre)	14	No additional information.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Maximum 2 applications/yr. 12-hr re-entry interval.
		Actara 240SC	109 mL/ha (44 mL/acre)	—	No additional information.

[1] Do not apply a foliar neonicotinoid spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment. See *Caution*, on page 164.

[2] Row spacing: 90 cm (36 in.)

Table 3–128. Potato Insect Control — Colorado Potato Beetle

For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE (cont'd)					
Foliar Sprays (cont'd)					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	1	Early applications on larval stages provide best control. Will also control European corn borer. 12-hr re-entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (300–400 mL/acre)	7	Use the higher application rate when larger larvae are present. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC Silencer 120 EC	83–125 mL/ha (34–51 mL/acre)	7	Use the higher rate for larger instars and infestations. Maximum 3 applications/yr at the low rate or 2 applications/yr at the high rate. Do not exceed 250 mL/ha/yr (100 mL/acre/yr). 24-hr re-entry interval.
	cypermethrin	Ripcord 400 EC	62.5–125 mL/ha (25.3–51 mL/acre)	7	No additional information.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	12-hr re-entry interval.
	permethrin	Perm-UP	180–260 mL/ha (73–105 mL/acre)	7	12-hr re-entry interval.
carbamate (group 1A)	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	24-hr re-entry interval.
organophosphate (group 1B)	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	48-hr re-entry interval.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	14	Maximum 2 applications/yr. Apply at egg hatch to 2nd instar. Also controls European corn borer (small larvae).

[1] Do not apply a foliar neonicotinoid spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment. See *Caution*, on page 164.

[2] Row spacing: 90 cm (36 in.)

Caution

The Colorado potato beetle (CPB) has the ability to develop resistance to insecticides very rapidly. Several insecticides for CPB control belong to the neonicotinoid chemical family. To delay the development of resistance to neonicotinoids, the following practices are strongly suggested:

- Do not apply a neonicotinoid foliar spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment.
- Use label rates.
- Scout fields regularly to evaluate the efficacy of insecticide treatments.
- If control of CPB is poor after an insecticide application, collect CPB samples and have them tested for resistance.

CPB has developed resistance to most of the pyrethroid insecticides. Conduct a backpack spray test in a small area of the field before applying a pyrethroid to the entire field.

Table 3–129. Potato Insect Control — Potato Leafhopper, Flea Beetle, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POTATO LEAFHOPPER, FLEA BEETLE, TARNISHED PLANT BUG					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Also controls European corn borer. Maximum 3 ground applications or 2 aerial applications/yr. 24-hr re-entry interval.
		Silencer 120 EC			
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	3	Maximum 3 applications/yr.
	permethrin	Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	1	12-hr re-entry interval.
		Perm-UP			
		Ambush 500 EC	140–200 mL/ha (57–81 mL/acre)	—	Use higher rate for heavy infestations. Also controls European corn borer. 12-hr re-entry interval.
	cypermethrin	Ripcord 400 EC	62.5–125 mL/ha (25.3–51 mL/acre)	7	Use high rate on tarnished plant bug.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	Use 200 mL/ha or 40 mL/acre for tarnished plant bug. 12-hr re-entry interval.
organophosphate (group 1B)	dimethoate	Lagon 480 E	0.55–1.1 L/ha (0.22–0.4 L/acre)	7	**Leafhoppers only.**
		Cygon 480			No additional information.
	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	Not for tarnished plant bug. 48-hr re-entry interval.
	acephate	Orthene 75 SP	0.75–1.1 kg/ha (0.3–0.4 kg/acre)	21	Maximum 4 applications/yr. 24-hr re-entry interval.
	chlorpyrifos	Lorsban 4E/NT	1 L/ha (0.4 L/acre)	7	Not for leafhopper. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
	phosmet	Imidan 70-WP	1.6 kg/ha (0.64 kg/acre)	7	Not for tarnished plant bug. Monitor the aphid populations closely after Imidan applications. 5-day restricted entry interval.
carbamate (group 1A)	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	24-hr re-entry interval.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex 50W WSP	1.1–1.5 kg/ha (0.4–0.6 kg/acre)	5	5-day re-entry interval.
not classified	kaolin	Surround WP	6.25–12.5 kg/ha (2.5–5.1 kg/acre)	—	**For suppression of leafhoppers only.** For early applications, use the higher labelled rate per 250 L of water; follow-up applications may only require the lower labelled rate per 250 L of water.

Table 3–130. Potato Insect Control — Late-Season Cutworms, Spider Mites, Wireworms, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LATE-SEASON CUTWORMS					
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL/ha (70 mL/acre)	7	No additional information.
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	7	Apply in early evening for maximum control. 24-hr re-entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Variegated cutworm. Use high rate on dry soils or large larvae. Apply up to 5-leaf stage. Do not disturb ground for 5 days following application. 12-hr re-entry interval.
		Perm-UP	180 mL/ha (73 mL/acre)	—	
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	1	Variegated cutworm. Maximum 4 applications/yr. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	7	Variegated cutworm. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
SPIDER MITES					
avermectin (group 6)	abamectin	Agri-Mek 1.9% EC	1 L/ha (404 mL/acre)	14	Apply in 185 L of water/ha or 74 L of water/acre. Apply when spider mites first appear.
WIREWORMS					
organophosphate (group 1B)	phorate	Thimet 15-G	15.6–23.9 kg/ha (6.31–9.67 kg/acre)[1]	—	Due to soil adaptation, repeated annual applications of phorate (Thimet 15-G) to the same soil may result in significantly reduced insecticide persistence in the second and subsequent years of application. Do not use it on varieties that will be harvested in less than 90 days after planting.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	—	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

[1] Row spacing: 90 cm

Table 3–131. Potato Insect Control — European Corn Borer, Cabbage Looper, Armyworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER					
diamide (group 28)	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	7	Time application to coincide with peak egg hatch. Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
CABBAGE LOOPER					
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec CAF	1.4–2.8 L/ha (0.56–0.11 L/acre)	0	Apply at first signs of infestation when larvae are small. Use a wetting agent to improve wetting and distribution on difficult to wet foliage.
diamide (group 28)	cyantraniliprole	Exirel	250–500 mL/ha (100–200 mL/acre)	7	Use high rate under heavy pest pressure. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
ARMYWORMS					
diamide (group 28)	cyantraniliprole	Exirel	500 mL/ha (200 mL/acre)	7	Fall armyworm control. Do not apply a foliar cyantraniliprole application following a soil or seed treatment application of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3-132. Potato Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Application					
neonicotinoid[1] (group 4A)	imidacloprid	Admire 240 F Alias 240 SC Grapple$_2$	0.85–1.3 L/ha[2] (0.34–0.5 L/acre)[2]	7	Also controls leafhoppers and flea beetles. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 240SC	378–488.9 mL/ha[2] (153–198 mL/acre)[2]	90	Also controls leafhoppers. See label for rotational crop restrictions. Maximum 1 application/yr.
Foliar Applications					
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG[3]	193 g/ha (78 g/acre)	14	12-hr re-entry interval. See label for recropping restrictions. Maximum 2 applications/yr.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–64 g/acre)	7	Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. 12-hr re-entry interval.
neonicotinoid[1] (group 4A)	imidacloprid	Admire 240 F Alias 240 SC Grapple$_2$	200 mL/ha (81 mL/acre)	7	Maximum 2 applications/yr for all uses. See label for rotational crop restrictions. 24-hr re-entry interval.
	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not make more than 2 applications/yr. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	109 mL/ha (44 mL/acre)	7	See label for rotational crop restrictions. Maximum 2 applications/yr. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	Rotate with insecticides with different mode of action. Do not make applications less than 7 days apart. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or until residues have dried.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (200–600 mL/acre)	7	Use high rate under heavy pest pressure. Apply with Hasten NT Spray Adjuvant at rate of 0.25% v/v or MSO Concentrate with Leci-Tech at rate of 0.5% v/v. Do not apply a foliar cyantraniliprole application following a soil or seed treatment of a Group 28 insecticide. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Should be tank-mixed with spray adjuvant/additive having spreading and penetrating properties. See label for further details. See label for recropping restrictions. 12-hr re-entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480 Lagon 480 E	0.55–1.1 L/ha (0.22–0.4 L/acre)	7	No additional information.
	acephate	Orthene 75 SP	0.75–1.1 kg/ha (0.3–0.4 kg/acre)	21	**Green peach and potato aphids only.** Maximum 4 applications/yr. 12-hr re-entry interval.
	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	**Green peach and potato aphids only.** 24-hr re-entry interval.
not classified	mineral oil	Superior 70 Oil	10 L/ha (4 L/acre)	14	Mineral oil acts as an aphid deterrent. It reduces the spread of PVY vectored by aphids. Thorough coverage is essential. Apply at 10 L of product/1,000 L of water/ha at 100–200 psi. Spray at one week intervals as soon as aphids are present. Maximum 10 applications/yr.

[1] Do not apply a neonicotinoid foliar spray in fields where a neonicotinoid was used either in-furrow or as a seed treatment.
[2] Row spacing: 90 cm.
[3] Fulfill 50WG causes cessation of aphid feeding shortly after application. Aphids may remain on the plant for 2–4 days before they die.

RADISHES

In this section:

Table 3-133. Radish Seed Treatments
Table 3-134. Activity of Fungicides on Radish Diseases
Table 3-135. Radish Disease Control
Table 3-136. Activity of Insecticides on Radish Insects
Table 3-137. Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms
Table 3-138. Radish Insect Control — Swede Midge, Aphids, European Chafer Grubs

This information is provided as a guideline only. See product labels for complete information.

Table 3–133. Radish Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	Radish and Oriental radish. **For use in commercial seed-treatment plants only.**
Thiram 75 WP	thiram	90 g/ 25 kg seed	seed decay and damping-off	Radish. Seed box treatment.
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	damping off (*Rhizoctonia*)	Radish and Oriental radish. **For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–134. Activity of Fungicides on Radish Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Alternaria	Powdery Mildew	Downy Mildew	Rhizoctonia Root Rot, Crown Rot, Stem Canker	Botrytis Gray Mold
metalaxyl-M and S	Apron XL LS	C	—	—	—	—	—
	Ridomil Gold 480SL	—	—	—	S	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—
pyraclostrobin	Cabrio EG	—	C	C	—	—	—
trifloxystrobin	Flint	—	C	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—
penthiopyrad	Fontelis	—	—	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C

Table 3–135. Radish Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, POWDERY MILDEW					
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Radish and Oriental radish. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand harvesting. 12-hr re-entry interval for all other activities.
	trifloxystrobin	Flint	280 g/ha (113 g/acre)	7	**Radish only. Alternaria only.** See label for recropping restrictions. When possible, rotate with fungicides with a different mode of action, otherwise avoid consecutive applications of Group 11 fungicides. 12-hr re-entry interval.
DOWNY MILDEW					
phenylamide (group 4)	metalaxyl-M and S	Ridomil Gold 480SL	1.2–2.4 L/ha (0.5–1 L/acre)	21	**Radish only. Suppression of downy mildew only.** Apply by broadcast or banding (18-cm band) before or at-planting. Do not apply after planting. Apply in sufficient water to provide coverage of soil. Maximum 1 application/yr. 12-hr re-entry interval.
RHIZOCTONIA — ROOT ROT, CROWN ROT, STEM CANKER					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	15	Radish. See label for recropping restrictions. Maximum 1 application/yr; applied in-furrow at planting or banded soon after emergence. 12-hr re-entry interval.
				40	Oriental radish (daikon). See label for recropping restrictions. Maximum 1 application/yr; applied in-furrow at planting or banded soon after emergence. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Radish and Oriental radish. Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
anilino-pyrimidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–395 g/acre)	7	Radish and Oriental radish. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–136. Activity of Insecticides on Radish Insects

LEGEND: C = control
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cabbage Maggot	Flea Beetles	Aphids	Cabbage Looper	Imported Cabbageworm	Diamondback Moth	Cutworms	Swede Midge	European Chafer Grubs
chlorpyrifos	Lorsban 4E/NT	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	C	—	—	—	—	—	—	—	—
	Nufos 4E	C	—	—	—	—	—	—	—	—
	Warhawk 480 EC	C	—	—	—	—	—	—	—	—
carbaryl	Sevin XLR	—	C	—	—	C	C	—	—	—
permethrin	Pounce 384EC	—	C	—	—	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—	—	—
	Ambush 500EC	—	C	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	—	C	C	—	—	—	—	—	RD
malathion	Malathion 85E	—	C	N	—	—	—	—	—	—
thiamethoxam	Actara 25WG	—	—	C	—	—	—	—	—	—
sulfoxaflor	Closer	—	—	C	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—	—	—	—
spinosad	Success	—	—	—	C	C	C	—	—	—
	Entrust	—	—	—	C	C	C	—	—	—
spinetoram	Delegate WG	—	—	—	C	C	C	—	—	—
Bacillus thuringiensis	Dipel 2X DF	—	—	—	C	C	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	C	C	C	C	—

Table 3–137. Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE MAGGOT					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT, Pyrinex 480 EC, Nufos 4E, Warhawk 480 EC	85 mL in 380 L water/1,000 m of row (26 mL in 30 gal water/1,000 ft of row)	21	Radish. Apply as a drench at time of seeding. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			210 mL in 1,000 L water/1,000 m of row (64 mL in 79 gal water/1,000 ft of row)	32	Asian radish (lo bok, daikon). See label for recropping restrictions. Apply as a drench at 7, 20 and 35 days after seeding. 24-hr re-entry interval.
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	**Radish only.**
pyrethroid (group 3A)	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	2	**Radish only.** 12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140 mL/ha (57 mL/acre)	2	
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Radish and Oriental radish. Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
CABBAGE LOOPER, IMPORTED CABBAGEWORM, DIAMONDBACK MOTH					
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	3	Radish and Oriental radish. Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	3	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	Radish and Oriental radish. Use the higher rate for high infestations or advanced growth stages of the target pest. Maximum 3 applications/yr. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	55–550 g/ha (22–223 g/acre)	0	**Asian radish only.** Use 275–550 g/ha (111–223 g/acre) for loopers.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Radish and Oriental radish. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Radish and Oriental radish. Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250 mL/ha (101 mL/acre)	1	Radish and Oriental radish. Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.

Table 3–138. Radish Insect Control — Swede Midge, Aphids, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	When possible, rotate with other products registered for Swede midge control, otherwise avoid sequential applications for resistance management. 12-hr re-entry interval.
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	7	**Radish only.** Control of aphids with these products has been inconsistent in many areas.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Radish and Oriental radish. Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Radish and Oriental radish. Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Radish and Oriental radish. Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Radish and Oriental radish. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Radish and Oriental radish. Thorough spray coverage is essential for optimum control. Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Radish and Oriental radish. **Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.

RHUBARB

In this section:

Table 3–139. Activity of Insecticides on Rhubarb Insects
Table 3–140. Rhubarb Insect Control

This information is provided as a guideline only. See product labels for complete information.

Table 3–139. Activity of Insecticides on Rhubarb Insects

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Potato Stem Borer	Cabbage Looper	Slugs
acetamiprid	Assail 70WP	C	—	—	—
sulfoxaflor	Closer	C	—	—	—
spinetoram	Delegate WG	—	—	C	—
spinosad	Entrust	—	—	C	—
	Success 480SC	—	C	C	—
pymetrozine	Fulfill 50WG	C	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—
methoxyfenozide	Intrepid	—	—	C	—
spirotetramat	Movento 240 SC	C	—	—	—
chlorantraniliprole	Coragen	—	—	C	—
cyantraniliprole	Exirel	C	—	—	—
ferric phosphate	Sluggo Professional	—	—	—	C

Table 3–140. Rhubarb Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Use high rate under heavy pest pressure. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	12-hr re-entry interval or until residues have dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. Minimum 30-day plant-back restriction for all crops. Maximum 2 applications/season. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Use high rate for heavy infestations. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Should be tank-mixed with an adjuvant/additive having spreading and penetrating properties. See label for further detail. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. Apply with Hasten NT Spray Adjuvant at rate of 0.25% v/v or MSO Concentrate with Leci-Tech at rate of 0.5% v/v. See label for tank-mix directions and crop tolerance information. Do not exceed 4.5 L/ha/season. 12-hr re-entry interval.
POTATO STEM BORER, CABBAGE LOOPER					
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Cabbage looper. Rotate with insecticides with a different mode of action. Maintain a spray pH of 6 or higher. Re-entry permitted when residues are dry.
		Success	182 mL/ha (74 mL/acre)	1	Potato stem borer and cabbage looper. Maintain a spray pH of 6 or higher.
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	Cabbage looper. Use the high rate for heavy infestations or large larvae. 12-hr re-entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Cabbage looper. Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for recropping interval. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Cabbage looper. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Cabbage looper. Also controls cutworms, corn earworm and armyworm. Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. 12-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Use higher rates on severe infestations.

RUTABAGAS

In this section:

Table 3-141. Rutabaga Seed Treatments
Table 3-142. Activity of Fungicides on Rutabaga Diseases
Table 3-143. Rutabaga Disease Control
Table 3-144. Activity of Insecticides on Rutabaga Insects
Table 3-145. Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars
Table 3-146. Rutabaga Insect Control — Cutworms, Aphids
Table 3-147. Rutabaga Insect Control — European Chafer Grubs, Swede Midge

This information is provided as a guideline only. See product labels for complete information.

Table 3–141. Rutabaga Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**For use in commercial seed-treatment plants only.**
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	damping off (*Rhizoctonia*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–142. Activity of Fungicides on Rutabaga Diseases

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Downy Mildew	Powdery Mildew	Rhizoctonia	Alternaria	Botrytis Gray Mold
metalaxyl-M and S	Apron XL LS	C	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—
fosetyl-AL	Aliette WDG	—	C	—	—	—	—
fluopicolide + fosetyl-AL	Presidio + Aliette WDG	—	C	—	—	—	—
propiconazole	Topas	—	—	C	—	—	—
	Mission 418 EC	—	—	C	—	—	—
pyraclostrobin	Cabrio EG	—	—	C	—	C	—
sulphur	Microscopic Sulphur	—	—	C	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	C	—	—
trifloxystrobin	Flint	—	—	—	—	C	—
penthiopyrad	Fontelis	—	—	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C

Table 3–143. Rutabaga Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MOSAIC VIRUS					
not classified	mineral oil	Superior 70 Oil	11 L in 550–1,100 L of water/ha (4.4 L in 50–100 gal of water/acre)	21	Do not apply mineral oil in direct sunlight. **Aphid feeding deterrent only.** 12-hr re-entry interval.
DOWNY MILDEW					
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.25–3.12 kg in minimum 100 L water/ha (0.9–1.26 kg in minimum 10 gal water/acre)	7	Spray at 7-day intervals as required. Maximum 5 applications/yr. 12-hr re-entry interval.
benzamide + phosphonate (group 43 + 33)	fluopicolide + fosetyl-AL	Presidio + Aliette WDG	220–292 mL/ha + 2.25–3.12 kg/ha (89–118 mL/acre + 0.9–1.25 kg/acre)	7	Do not make sequential applications. See label for rotational crop restrictions. 12-hr re-entry interval.
POWDERY MILDEW					
DMI (group 3)	propiconazole	Topas	400 mL in minimum 200 L water/ha (162 mL in minimum 18 gal water/acre)	21	A second application may be made 20 days after the first. Maximum 2 applications/season. 12-hr re-entry interval.
		Mission 418 EC	240 mL in minimum 200 L water/ha (97 mL in minimum 18 gal water/acre)	21	Make 2 applications/yr: the first application 50 days after planting and the second application 20 days later. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (0.23–0.34 kg/acre)	3	See label for recropping restrictions. Maximum 3 applications/season. 12-hr re-entry interval. 3-day re-entry interval for hand-harvesting.
inorganic (group M1)	sulphur	Microscopic Sulphur	6.8 kg in 675–1,125 L water/ha (2.75 kg in 60–100 gal water/acre)	—	Maximum 5 applications/season. This product is not compatible with Superior 70 Oil. 24-hr re-entry interval.
RHIZOCTONIA					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	See label for recropping restrictions. Maximum 1 application/yr; applied in-furrow at planting or banded soon after emergence. 12-hr re-entry interval.
ALTERNARIA					
QoI (group 11)	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Use higher rate and shorter spray interval when disease pressure is high. When possible, rotate with fungicides with a different mode of action, otherwise avoid consecutive applications of Group 11 fungicides. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
anilino-pyramidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–144. Activity of Insecticides on Rutabaga Insects

LEGEND: C = control
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cabbage Maggot	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Aphids	European Chafer Grubs	Swede Midge
chlorpyrifos	Lorsban 15G	C	—	—	—	—	—	—
	Pyrifos 15G	C	—	—	—	—	—	—
	Lorsban 4E/NT	C	—	—	C	—	—	—
	Pyrinex 480 EC	C	—	—	C	—	—	—
	Nufos 4E	C	—	—	C	—	—	—
	Warhawk 480 EC	C	—	—	C	—	—	—
carbaryl	Sevin XLR	—	C	C[1]	—	—	—	—
cypermethrin	Ripcord 400 EC	—	C	—	—	—	—	—
	Up-Cyde 2.5 EC	—	C	—	—	—	—	—
imidacloprid	Admire 240 F	—	C	—	—	C	RD	—
malathion	Malathion 85E	—	—	C[2]	—	N	—	—
spinosad	Success	—	—	C	—	—	—	—
	Entrust	—	—	C	—	—	—	—
spinetoram	Delegate WG	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	C	—	—	C
thiamethoxam	Actara 25WG	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	C	—	—
flonicamid	Beleaf 50SG	—	—	—	—	C	—	—
acetamiprid	Assail 70 WP	—	—	—	—	—	—	C

[1] For control of imported cabbageworm and diamondback moth only.
[2] For control of imported cabbageworm and cabbage loopers only.

Table 3–145. Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE ROOT MAGGOT					
Treatment at planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 15G	0.6–1 kg/1,000 m of row (0.18–0.3 kg/1,000 ft of row)	30	See label for recropping restrictions. 24-hr re-entry interval.
		Pyrifos 15G			In-furrow, at-planting application. See label for recropping restrictions. Maximum 1 application/season. 24-hr re-entry interval.
Treatment after planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	210 mL/1,000 m of row (in 125 L of water) (64 mL/1,000 ft of row (in 11 gal of water))	30	Apply on soil, 10 cm (4 in.) on each side of the plant, 10, 28, 49 and 70 days after seeding. See label for recropping restrictions. 24-hr re-entry interval.
		Nufos 4E			
		Warhawk 480 EC			
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	No additional information.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	123 mL/ha (50 mL/acre)	21	No additional information.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	21	12-hr re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
LEAF-EATING CATERPILLARS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	**Imported cabbageworm and cabbage loopers only.** Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	3	Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	3	
	spinetoram	Delegate WG	140–200 g/ha (56–81 g/acre)	3	Use the higher rate for high infestations or advanced growth stages of the target pest. Maximum 3 applications/yr. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.

Table 3–146. Rutabaga Insect Control — Cutworms, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT Pyrinex 480 EC Nufos 4E Warhawk 480 EC	1.2–2.4 L in 200–400 L water/ha (0.5–1 L in 20–40 gal water/acre)	30	May be used at the rate of 2.4 L/ha (1.0 L/acre) as a preplanting treatment. Apply once at seedling stage (2 to 5 leaves), when damage first appears. See label for recropping restrictions. 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250 mL/ha (101 mL/acre)	1	Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.

Table 3–146. Rutabaga Insect Control — Cutworms, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Thorough spray coverage is essential for optimum control. Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.

Table 3–147. Rutabaga Insect Control — European Chafer Grubs, Swede Midge

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
SWEDE MIDGE					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (34 g/acre)	7	Adequate spray coverage is essential for optimal control. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.

SPINACH AND SWISS CHARD

In this section:

Table 3-148. Spinach and Swiss Chard Seed Treatments
Table 3-149. Activity of Fungicides on Spinach Diseases
Table 3-150. Spinach Disease Control — Downy Mildew, White Rust
Table 3-151. Spinach Disease Control — Anthracnose, Botrytis Gray Mold
Table 3-152. Activity of Insecticides on Spinach Insects
Table 3-153. Spinach Insect Control — Aphids
Table 3-154. Spinach Insect Control — Leafminers, Cutworms
Table 3-155. Spinach Insect Control — Cabbage Looper, Brown Marmorated Stink Bug
Table 3-156. Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects
Table 3-157. Swiss Chard Disease Control — Botrytis Gray Mold
Table 3-158. Swiss Chard Insect Control — Aphids
Table 3-159. Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper, Brown Marmorated Stink Bug

This information is provided as a guideline only. See product labels for complete information.

Table 3-148. Spinach and Swiss Chard Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**Spinach only. For use in commercial seed-treatment plants only.** Not for greenhouse-grown spinach.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	seed rot and damping-off (*Rhizoctonia solani*)	Spinach and Swiss chard. **For import use only.** Not for domestic commercial or on-farm seed treatment.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay and damping-off	**Spinach only.** Seed box treatment.

Table 3–149. Activity of Fungicides on Spinach Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Downy Mildew	White Rust	Anthracnose	Botrytis Gray Mold
metalaxyl-M and S	Apron XL LS	C	—	—	—	—
	Ridomil Gold 480SL	—	C	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—
thiram	Thiram 75 WP	C	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	S	—	—	—
azoxystrobin	Quadris Flowable	—	C	—	—	—
fenamidone	Reason 500SC	—	S	—	—	—
fosetyl-AL	Aliette WDG	—	S	S	—	—
fluopicolide + fosetyl-AL	Presidio + Aliette WDG	—	C	—	—	—
mandipropamid	Revus	—	C	—	—	—
copper sulphate	Copper 53W	—	C	C	—	—
cyazofamid	Ranman 400SC	—	—	S	—	—
	Torrent 400SC	—	—	S	—	—
Bacillus subtilis	Serenade ASO	—	—	S	—	—
fludioxonil/cyprodinil	Switch 62.5 WG	—	—	—	C	C
penthiopyrad	Fontelis	—	—	—	—	C

Table 3–150. Spinach Disease Control — Downy Mildew, White Rust

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
phenylamide (group 4)	metalaxyl-M and S	Ridomil Gold 480SL	1 L/ha (0.4 L/acre)	—	Pre-plant incorporated application; apply at planting as a banded application over row. Maximum 1 application/season. 12-hr re-entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1.6 kg/ha (0.6 kg/acre)	0	**Suppression only.** See label for recropping restrictions. Maximum 2 applications/season. 9-day re-entry for hand-harvesting and thinning. 24-hr re-entry interval for all other activities.
QoI (group 11)	azoxystrobin	Quadris Flowable	1.125 L/ha (455 mL/acre)	7	Begin applications prior to disease development. Maximum 2 applications/season. 12-hr re-entry interval.
	fenamidone	Reason 500SC	400 mL/ha (162 mL/acre)	2	**Suppression only.** Begin application at the onset of disease. See label for recropping restrictions. Maximum 4 applications/season. Re-entry permitted once spray deposit has dried.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	3.38–4.5 kg/ha (1.4–1.8 kg/acre)	3	**Suppression only.** Begin applications when conditions favour disease development. Maximum 7 applications/season. 12-hr re-entry interval.
benzamide + phosphonate (group 43 + 33)	fluopicolide + fosetyl-AL	Presidio + Aliette WDG	220–292 mL/ha + 3.38–4.5 kg/ha (89–118 mL/acre + 1.4–1.8 kg/acre)	3	Begin applications prior to disease development. Use the lower rate and longer interval as preventive applications. Use the higher rate and shorter interval if disease is present. Do not apply more than 2 applications before rotating to fungicides with different modes of action. See label for rotational crop restrictions. Do not apply more than 880 mL of Presidio/ha/season. 12-hr re-entry interval.
carboxylic acid amide (group 40)	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	Use of a non-ionic adjuvant (0.25% v/v) is suggested. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
inorganic (group M1)	copper sulphate	Copper 53W	2.5 kg/ha (1 kg/acre)	1	Ensure thorough plant coverage. Maximum 5 applications/yr. 48-hr re-entry interval.
WHITE RUST					
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	150–200 mL/ha (61–81 mL/acre)	1	**Suppression only.** Do not make sequential applications. Tank-mix with non-ionic or organosilicone surfactant. See label for directions. See label for recropping restrictions. Maximum of 5 applications/crop/yr. 12-hr re-entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	3.38–4.5 kg/ha (1.4–1.8 kg/acre)	3	**Suppression only.** Begin applications when conditions favour disease development. Maximum 7 applications/season. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–8 L/ha (1.6–3.2 L/acre)	0	**Suppression only.** Begin applications when conditions become conducive for disease development. Repeat at 7–10-day intervals.
inorganic (group M1)	copper sulphate	Copper 53W	2.5 kg/ha (1 kg/acre)	1	Ensure thorough plant coverage. Maximum 5 applications/yr. 48-hr re-entry interval.

Table 3–151. Spinach Disease Control — Anthracnose, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE					
anilino-pyrimidine/ phenylpyrrole (group 9/12)	fludioxonil/ cyprodinil	Switch 62.5 WG	775–975 g/ha (314–394 g/acre)	3	Make preventive applications when conditions are favourable for disease. Use high rate when disease pressure is high. See label for recropping restrictions. Maximum 2 applications/yr. 3-day re-entry interval for harvesting. 12-hr re-entry interval for all other activities.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Use higher rate and shorter spray interval when disease pressure is high. Do not make more than 2 applications before rotating to fungicides with different modes of action. See label for rotational crop restrictions. Apply no more than 5.25 L/ha/season. 12-hr re-entry interval.
anilino-pyrimidine/ phenylpyrrole (group 9/12)	fludioxonil/ cyprodinil	Switch 62.5 WG	775–975 g/ha (314–394 g/acre)	3	Make preventive applications when conditions are favourable for disease. Use high rate when disease pressure is high. See label for recropping restrictions. Maximum 2 applications/year. 3-day re-entry interval for harvesting. 12-hr re-entry interval for all other activities.

Table 3–152. Activity of Insecticides on Spinach Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Leafminers	Aphids	Cabbage Looper	Cutworms	Brown Marmorated Stink Bug
malathion	Malathion 25W	C[1]	C	—	—	—
	Malathion 85E	—	C	—	—	S
acetamiprid	Assail 70 WP	RD[2]	C	—	—	—
thiamethoxam	Actara 240SC	C[3]	C	—	—	—
	Actara 25WG	—	C	—	—	—
cyromazine	Citation 75WP	C[2]	—	—	—	—
chlorantraniliprole	Coragen	C[4]	—	C	C	—
cyantraniliprole	Exirel	C[3]	C	C	C	—
imidacloprid	Admire 240 F	—	C	—	—	—
sulfoxaflor	Closer	—	C	—	—	—
pymetrozine	Fulfill 50WG	—	C	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—
spirotetramat	Movento 240 SC	—	C	—	—	—
spinosad	Success	—	—	C	—	—
	Entrust	—	—	C	—	—
spinetoram	Delegate WG	—	—	C	—	—
Bacillus thuringiensis	Thuricide HPC	—	—	C	—	—
	Dipel 2X DF	—	—	C	—	—
	Bioprotec CAF	—	—	C	—	—
methoxyfenozide	Intrepid	—	—	C	—	—

[1] Leafminers.
[2] Pea leafminers only.
[3] Dipteran leafminers.
[4] Vegetable & serpentine leafminers only.

Table 3–153. Spinach Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	10.2 mL/1,000 plants	21	Transplant tray plug drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Gloves must be worn at transplanting. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			6 mL/100 m of row (1.8 mL/100 ft of row)	21	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Also suppresses leafhoppers. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Actara 25WG is also effective at reducing damage by tarnished plant bug at a rate of 210 g/ha with a maximum of 1 application/season. See label for rotational crop restrictions. Maximum 2 application/season. 12-hr re-entry interval.
		Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Also controls leafhoppers and suppresses early-season flea beetles. Soil application at or shortly following seeding or transplanting. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. Do not apply through irrigation equipment. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–153. Spinach Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS (cont'd)					
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. Do not exceed 730 mL/ha/season. See label for further details. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–154. Spinach Insect Control — Leafminers, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
organophosphate (group 1B)	malathion	Malathion 25W	5.5–7 kg/ha (2.2–2.8 kg/acre)	7	Leafminers.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	**Reduction in damage caused by pea leafminers only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Dipteran leafminers. Also controls leafhoppers and suppresses early-season flea beetles. Soil application at or shortly following seeding or transplanting. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow, transplant or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g in 200 L water/ha (76 g in 18 gal water/acre)	7	**Pea leafminers only.** See label for rotational crop restrictions. Maximum 5 applications/season. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	**Vegetable and serpentine leafminers only.** Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Dipteran leafminers. Use high rate under heavy pest pressure. For optimum control of leafminers, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	cyantraniliprole	Exirel	500–750 mL/ha (202–303 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–155. Spinach Insect Control — Cabbage Looper, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	1	Maintain a spray water pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	1	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	Maximum 3 applications/yr. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Thuricide HPC	2–4.25 L/ha (0.8–1.72 L/acre)	0	No additional information.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for rotational crop restrictions. Do not exceed 2 L product/ha/year. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,345 mL/ha (544 mL/acre)	7	**Suppression only.** Maximum 2 applications/season.

Table 3–156. Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects

LEGEND: C = control
S = suppression
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Botrytis Gray Mold	Leafminers	Aphids	Cabbage Looper	Cutworms	Brown Marmorated Stink Bug
Fungicides								
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—
penthiopyrad	Fontelis	—	C	—	—	—	—	—
Insecticides								
acetamiprid	Assail 70 WP	—	—	RD[1]	C	—	—	—
cyromazine	Citation 75WP	—	—	C[1]	—	—	—	—
chlorantraniliprole	Coragen	—	—	C[2]	—	C	C	—
cyantraniliprole	Exirel	—	—	C[3]	C	C	C	—
dimethoate	Cygon 480	—	—	—	C	—	—	—
	Lagon 480 E	—	—	—	C	—	—	—
malathion	Malathion 85E	—	—	—	N	—	—	S
thiamethoxam	Actara 25WG	—	—	—	C	—	—	—
imidacloprid	Admire 240 F	—	—	—	C	—	—	—
sulfoxaflor	Closer	—	—	—	C	—	—	—
pymetrozine	Fulfill 50WG	—	—	—	C	—	—	—
flonicamid	Beleaf 50SG	—	—	—	C	—	—	—
spirotetramat	Movento 240 SC	—	—	—	C	—	—	—
spinosad	Success	—	—	—	—	C	—	—
	Entrust	—	—	—	—	C	—	—
spinetoram	Delegate WG	—	—	—	—	C	—	—
methoxyfenozide	Intrepid	—	—	—	—	C	—	—

[1] Pea leafminers only.
[2] Vegetable & serpentine leafminers only.
[3] Dipteran leafminers.

Table 3–157. Swiss Chard Disease Control — Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Use higher rate and shorter spray interval when disease pressure is high. Do not make more than 2 applications before rotating to fungicides with different modes of action. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–158. Swiss Chard Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	7	No additional information.
		Lagon 480 E			
	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	Ensure thorough coverage, repeat as necessary. Control of aphids with malathion has been inconsistent in many areas. Apply when temperature is at or above 20°C.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply in sufficient water volume to ensure adequate coverage. Use at least 100 L of water/ha. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Actara 25WG is also effective at reducing damage by tarnished plant bug at rate of 210 g/ha with a maximum of 1 application/season. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	45	Soil application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. Do not apply through irrigation equipment. See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Tank-mix with spray adjuvant/additive having spreading and penetrating properties. See label for application details. See label for recropping restrictions. Do not exceed 730 mL/ha/season. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. For optimum control of aphids, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.

Table 3–159. Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	**Reduction in damage caused by pea leafminers only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Maximum 5 applications/season. 12-hr re-entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g in 200 L water/ha (76 g in 18 gal water/acre)	7	**Pea leafminers only.** See label for rotational crop restrictions. Maximum 5 application/season. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	**Vegetable and serpentine leafminers only.** Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Dipteran leafminers. Use high rate under heavy pest pressure. For optimum control of leafminers, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	cyantraniliprole	Exirel	500–750 mL/ha (202–303 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
CABBAGE LOOPER					
spinosyn (group 5)	spinosad	Success	182 mL/ha (74 mL/acre)	1	Maintain a spray water pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	1	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	Maximum 3 applications/yr. 12-hr re-entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for rotational crop restrictions. Do not exceed 2 L of Intrepid/ha/year. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. Do not exceed 4.5 L/ha/season. Maximum 4 applications/season. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	**Suppression only.** Maximum 1 application/season.

SUGARBEETS

In this section:

Table 3-160. Sugarbeet Seed Treatments
Table 3-161. Activity of Fungicides on Sugarbeet Diseases
Table 3-162. Sugarbeet Disease Control — Cercospora Leafspot
Table 3-163. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown Rot
Table 3-164. Activity of Insecticides on Sugarbeet Insects
Table 3-165. Sugarbeet Insect Control

This information is provided as a guideline only. See product labels for complete information.

Table 3–160. Sugarbeet Seed Treatments

Trade Name	Active Ingredients	Rate	Pests Controlled	Notes
Allegiance FL	metalaxyl	93 mL/ 100 kg seed	pythium seed rots, seedling blights	**For application by commercial seed treaters only.**
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/ 100 kg seed	pythium damping-off	**For use in seed treatment plant only.**
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	seed rot/pre-emergence damping-off caused by *Rhizoctonia solani*	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. See label for recropping restrictions.
Maxim 480FS	fludioxonil	5.2–10.4 mL/ 100 kg seed	seed- and soil-borne diseases (*Fusarium, Rhizoctonia, Aspergillus, Penicillium*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.
Thiram 75 WP	thiram	90 g/ 25 kg seed	seed decay, seedling blight, damping-off	Do not graze or feed treated clippings to livestock.
Cruiser 5FS	thiamethoxam	50–100 mL/ 100,000 seeds	wireworm	**For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–161. Activity of Fungicides on Sugarbeet Diseases

LEGEND: C = control
S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cercospora Leaf Spot	Rhizoctonia Root and Crown Rot	Powdery Mildew
thiophanate-methyl	Senator 70WP	C	—	—
difenoconazole	Inspire	C	—	C
metconazole	Caramba	C	—	—
prothioconazole	Proline 480 SC	C	C	—
tetraconazole	Mettle 125 ME	C	—	C
azoxystrobin/difenoconazole	Quadris Top	C	—	C
penthiopyrad	Vertisan	—	C	S
azoxystrobin	Quadris Flowable	—	C	—
pyraclostrobin	Headline EC	C	—	C
trifloxystrobin	Flint	—	—	C
copper hydroxide	Coppercide WP	C	—	—
	Parasol WG	C	—	—
sulfur	Microthiol Disperss	—	—	C
mancozeb	Manzate Pro-Stick	C	—	—
metiram	Polyram DF	C	—	—

Table 3–162. Sugarbeet Disease Control — Cercospora Leafspot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAFSPOT To manage fungicide resistance, all *Cercospora* fungicides should be tank-mixed with another fungicide from a different chemical group. The most common tank-mix partners are the dithiocarbamate and copper fungicides. There have been no resistance issues documented with the products listed from the M1 and M3 chemical groups.					
methyl-benzimidazole carbamates (group 1)	thiophanate-methyl	Senator 70WP	420–560 g/ha (170–227 g/acre)	21	Always tank-mix or rotate with a different fungicide group. **For sugarbeets grown for export use only.** Do not feed any part of treated plants to livestock.
DMI (group 3)	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	14	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
	metconazole	Caramba	1.0–1.25 L/ha (0.4–0.51 L/acre)	14	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 9-day re-entry interval.
	prothioconazole	Proline 480 SC	315–415 mL/ha (127–168 mL/acre)	7	Do not make more than 1 application before rotating to a different fungicide group. May be used with the lowest labelled rate of a non-ionic surfactant. See label for recropping restrictions. 24-hr re-entry interval.
	tetraconazole	Mettle 125 ME	950 mL/ha (384 mL/acre)	14	Maximum 1 application/year. Follow label instructions regarding use of tetraconazole in areas treated with the product in the previous season. See label for recropping restrictions. 3-day re-entry Interval for irrigation activities. 12-hr re-entry interval for other activities.
QoI (group 11)	pyraclostrobin	Headline EC	670–900 mL/ha (271–364 mL/acre)	7	Isolates of *Cercospora beticola* from Ontario have shown resistance to Group 11 fungicides. Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	7	Isolates of *Cercospora beticola* from Ontario have shown resistance to Group 11 fungicides. Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25–4.5 kg/ha (0.91–1.82 kg/acre)	1	Follow label instructions regarding addition of a suitable non-herbicidal agricultural oil at 4.5 L/ha.
		Parasol WG	2.25–4.5 kg/ha (0.91–1.82 kg/acre)	1	Follow label instructions regarding addition of a suitable non-herbicidal agricultural oil at 5.5 L/ha. 48-hr re-entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25 kg/ha (0.91 kg/acre)	21	Do not use treated beet tops for feed. 24-hr re-entry interval.
	metiram	Polyram DF	2.25 kg/ha (0.91 kg/acre)	21	Apply at 7–10-day intervals. Do not use treated beet tops for feed.

Table 3–163. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
DMI (group 3)	tetraconazole	Mettle 125 ME	950 mL/ha (384 mL/acre)	14	Maximum 1 application/year. Follow label instructions regarding use of tetraconazole in areas treated with the product in the previous season. See label for recropping restrictions. 3-day re-entry interval for irrigation activities. 12-hr re-entry interval for other activities.
	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	14	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
SDHI (group 7)	penthiopyrad	Vertisan	1.0–1.5 L/ha (0.4–0.6 L/acre)	7	**Suppression only.** Do not make more than 2 applications before rotating to a different fungicide group. See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	670–900 mL/ha (271–364 mL/acre)	7	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
	trifloxystrobin	Flint	182–244 g/ha (74–99 g/acre)	21	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	7	Do not make more than 1 application before rotating to a different fungicide group. See label for recropping restrictions. 12-hr re-entry interval.
inorganic (group M2)	sulfur	Microthiol Disperss	6 kg/ha (2.4 kg/acre)	1	24-hr re-entry interval.
RHIZOCTONIA ROOT AND CROWN ROT					
Soil Application					
SDHI (group 7)	penthiopyrad	Vertisan	15.5 mL/100 m of row (4.7 mL/100 ft of row)	7	Apply in-furrow at planting in sufficient water volume to obtain uniform application. See label for recropping restrictions. 12-hr re-entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	100	In-furrow application. Make only 1 application/yr. See label for recropping restrictions. 12-hr re-entry interval.
Over-the-Row Application					
DMI (group 3)	prothioconazole	Proline 480 SC	415 mL/ha (168 mL/acre)	7	May be used with the lowest labelled rate of a non-ionic surfactant. See label for recropping restrictions. 24-hr re-entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	0.5–1.1 L/ha (0.2–0.45 L/acre)	100	Banded over the row before the 6-leaf stage. Do not apply over the row if Quadris has previously been applied in-furrow. See label for recropping restrictions. 12-hr re-entry interval.

Table 3–164. Activity of Insecticides on Sugarbeet Insects

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Flea Beetles	Cutworms	Aphids	Leafhoppers	Spider Mites
chlorpyrifos	Lorsban 4E/NT	—	C	—	—	—
	Pyrinex 480 EC	—	C	—	—	—
	Warhawk 480 EC	—	C	—	—	—
malathion	Malathion 85E	C	—	—	—	—
naled	Dibrom	—	—	—	C	C
endosulfan	Thionex EC	—	—	C	—	—
permethrin	Ambush 500EC	—	C	—	—	—
	Perm-UP	—	C	—	—	—
	Pounce 384EC	—	C	—	—	—
chlorantraniliprole	Coragen	—	C	—	—	—

Table 3–165. Sugarbeet Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1.0 L/acre)	90	24-hr re-entry interval.
		Pyrinex 480 EC	1.2–2.4 L/ha (0.5–1.0 L/acre)	90	See label for recropping restrictions. 24-hr re-entry interval.
		Warhawk 480 EC	1.2–2.4 L/ha (0.5–0.9 L/acre)	90	See label for recropping restrictions. 24-hr re-entry interval.
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	See label for application instructions. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	See label for application instructions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
FLEA BEETLES, LEAFHOPPERS, SPIDER MITE					
organophosphate (group 1B)	malathion	Malathion 85E	535 mL/ha (217 mL/acre)	—	**Flea beetles.** Less effective below 20°C.
	naled	Dibrom	2.1 L/ha (0.85 L/acre)	5	**Spider mites, leafhoppers.** 48-hr re-entry interval.

SWEET CORN

In this section:

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Table 3-167. Activity of Fungicides on Sweet Corn Diseases
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Table 3-171. Sweet Corn Insect Control — European Corn Borer
Table 3-172. Sweet Corn Insect Control — Corn Earworm, Western Bean Cutworm, Fall Armyworm, Armyworm
Table 3-173. Sweet Corn Insect Control — Brown Marmorated Stink Bug, Aphids

This information is provided as a guideline only. See product labels for complete information.

Table 3–166. Sweet Corn Seed Treatments

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient(s)	Trade Name	Insects				Seedling Blights[1]				Notes
		Seedcorn Maggots	Wireworm	White Grubs	Flea Beetles	Penicillium	Pythium	Fusarium	Rhizoctonia	
Fungicide Only										
difenoconazole/ metalaxyl-M and S	Dividend XL RTA	—	—	—	—	C	C	C	—	**For use in commercial or on-farm seed treatment equipment only.** Use 325 mL/100 kg of seed. Do not graze or feed to livestock within 30 days of planting. See label for plant back restrictions.
metalaxyl	Allegiance FL	—	—	—	—	—	C	—	—	**For use in commercial seed-treatment plants only.** See the product labels for rates.
metalaxyl-M and S + fludioxonil	Apron XL LS + Maxim 480FS	—	—	—	—	C	C	C	C	**For use in commercial seed-treatment plants only.** See the product labels for rates.
azoxystrobin + fludioxonil	Dynasty 100FS + Maxim XL	—	—	—	—	C	C	C	C	**For use in commercial seed-treatment plants only.** See the product labels for rates.
thiram	Thiram 75WP	—	—	—	—	—	C	C	C	Seed box treatment. Use 55 g/25 kg of seed.
Insecticide Only										
clothianidin[2]	Poncho 600FS	C	C	C	C	—	—	—	—	**For use in commercial seed-treatment plants only.** See product label for rates. Will also control corn rootworm and black cutworm. See label for plant back restrictions.
imidacloprid[2]	Gaucho 480FL	—	C	—	C	—	—	—	—	**For use in commercial seed-treatment plants only.** See product label for rates. Request the high rate for flea beetles. Gaucho-treated seed should not be carried over.
thiamethoxam[2]	Cruiser 5FS	C	C	C	C	—	—	—	—	**For use in commercial seed-treatment plants only.** See product label for rates.
Insecticide + Fungicide										
diazinon/captan/ thiophanate-methyl	DCT	C	—	—	—	C	C	C	C	Seed box treatment. Use 125 g/25 kg of seed.
diazinon/ captan	Agrox B-2	C	—	—	—	—	C	C	C	Seed box or slurry treatment. Use 85 g/25 kg of seed. Do not use on seed previously treated with an insecticide. Use within 1 month of treatment.
	Agrox CD	C	—	—	—	—	C	C	C	Seed box treatment. Use 50 g/25 kg of seed. Do not use on seed previously treated with an insecticide. Use on seed previously treated with captan or thiram.
thiamethoxam[2] + fludioxonil + metalaxyl-M and S	Cruiser 5FS + Maxim 480FS + Apron XL LS	C	C	C	C	C	C	C	C	**For use in commercial seed-treatment plants only.** See the product labels for rates.
thiamethoxam[2] + fludioxonil + azoxystrobin	Cruiser 5FS + Maxim XL + Dynasty 100FS	C	C	C	C	C	C	C	C	

[1] Also known as 3–5 leaf dieback.

[2] Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–167. Activity of Fungicides on Sweet Corn Diseases

For information on seed decay, root rots and 3–5 leaf dieback, see *Table 3–166. Sweet Corn Seed Treatments,* on previous page.

LEGEND: C = control
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Rust	Northern Corn Leaf Blight	Common Smut	Stewart's Wilt[1]
propiconazole	Tilt 250E	C	C	—	—
	Bumper 418 EC	C	C	—	—
azoxystrobin/propiconazole	Quilt	C	C	—	—
penthiopyrad	Vertisan	C	—	—	—
azoxystrobin	Quadris Flowable	C	—	—	—
picoxystrobin	Acapela	—	C	—	—
pyraclostrobin	Headline EC	C	—	—	—
chlorothalonil	Bravo 500	C	—	—	—
	Echo 90DF	C	—	—	—

[1] See Flea Beetles in *Table 3–166. Sweet Corn Seed Treatments,* on previous page.

Table 3–168. Sweet Corn Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
RUST, NORTHERN CORN LEAF BLIGHT					
DMI (group 3)	propiconazole	Bumper 418 EC	150–300 mL/ha (61–121 mL/acre)	14	Use high rate for rust. Under severe disease pressure, make second application in 14 days. 12-hr re-entry interval.
		Tilt 250E	250–500 mL/ha (101–202 mL/acre)	14	
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	0.75–1 L/ha (0.3–0.4 L/acre)	14	Make the first application at the first sign of disease; use high rate only under conditions of high disease pressure. 14-day spray interval. 12-hr re-entry interval.
SDHI (group 7)	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	**Rust only.** Also suppresses grey leaf spot. See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	453 mL/ha (183 mL/acre)	7	**Rust only.**
	picoxystrobin	Acapela	530–800 mL/ha (214–323 mL/acre)	7	**Northern corn leaf blight only.** Use high rate and shorter interval when disease pressure is high. See label for rotational crop restrictions. 12-hr re-entry interval.
	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	**Rust only.** 12-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	3.2 L/ha (1.3 L/acre)	14	**Rust only.** 48-hr re-entry interval.
		Echo 90DF	1.8 kg/ha (0.7 kg/acre)		

Table 3–169. Activity of Insecticides on Sweet Corn Insects

For information on seed corn maggot, wireworm, white grubs and flea beetles, see *Table 3-166. Sweet Corn Seed Treatments*, page 200.

LEGEND: C = control
S = suppression
SC = some control of this pest may be expected when the product is used to control labelled pests
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Corn Rootworm (larvae)	Slugs	Cutworm	Aphids	Brown Marmorated Stink Bug	Fall Armyworm	European Corn Borer	Corn Earworm	Western Bean Cutworm
carbaryl	Sevin XLR	—	—	—	—	—	C	C	C	—
methomyl	Lannate TNG	—	—	—	—	S	—	C	C	—
acephate	Orthene 75 SP	—	—	—	—	—	—	C	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	C	—	—	—	—	—	—
	Nufos 4E	—	—	C	—	—	—	—	—	—
	Pyrifos 15G	C	—	S	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	—	—	—	—	—	—
	Warhawk 480 EC	—	—	C	—	—	—	—	—	—
acetamiprid	Assail 70WP	—	—	—	C	—	—	—	—	—
cypermethrin	Ripcord 400 EC	—	—	C	—	—	SC	C	N	—
	UP-Cyde 2.5 EC	—	—	SC	—	—	SC	C	—	—
deltamethrin	Decis 5 EC	—	—	—	—	—	SC	C	N	C
lambda-cyhalothrin	Matador 120EC	—	—	C	—	—	C	C	N	C
	Silencer 120 EC	—	—	C	—	—	C	C	N	SC
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	—	—	—	SC	C	C	C
permethrin	Pounce 384EC	—	—	C	—	—	C	C	N	—
	Perm-UP	—	—	C	—	—	C	C	N	—
	Ambush 500EC	—	—	C	—	—	C	C	N	—
tefluthrin	Force 3.0G	C	—	C	—	—	—	—	—	—
spinosad	Success	—	—	—	—	—	—	C	—	—
	Entrust	—	—	—	—	—	—	C	—	—
Bacillus thuringiensis	Dipel 2X DF	—	—	—	—	—	—	C	—	—
	Bioprotec CAF/3P	—	—	—	—	—	—	C	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	—	C	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	—	—	C	C	C	C
ferric phosphate	Sluggo Professional	—	C	—	—	—	—	—	—	—

Table 3–170. Sweet Corn Insect Control — Corn Rootworm, Cutworms, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CORN ROOTWORM					
organophosphate (group 1B)	chlorpyrifos	Pyrifos 15G	9.8 kg/ha[1] (3.9 kg/acre[2])	70	Apply in-furrow at planting at a rate of 75 g/100 m of row. Will also provide suppression of cutworms. See label for recropping restrictions. 24-hr re-entry interval.
pyrethroid (group 3A)	tefluthrin	Force 3.0G	5 kg/ha[1] (2 kg/acre[2])	49	Apply in-furrow at planting at a rate of 37.5 g/100 m of row. Will also control seed corn maggot, wireworm and cutworms. See label for recropping restrictions. 12-hr re-entry interval.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	70	Apply during 2–5-leaf stage. 24-hr re-entry interval. See label for recropping restrictions.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	175 mL/ha (71 mL/acre)	21	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application.
	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	1	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. 24-hr re-entry interval.
		Silencer 120 EC			
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworms. Use low rate for black cutworm. 12-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Use high rates on severe infestations.

[1] Row spacing: 75 cm.
[2] Row spacing: 30 in.

Table 3–171. Sweet Corn Insect Control — European Corn Borer

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	**Common Name**	**Trade Name**	**Rate**	**PHI**	**Notes**
EUROPEAN CORN BORER					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–4 L/ha (1–1.6 L/acre)	1	No additional information.
	methomyl	Lannate TNG	430–625 g/ha (174–253 g/acre)	3	24-hr re-entry interval.
organophosphate (group 1B)	acephate	Orthene 75 SP	563–825 g/ha (228–334 g/acre)	21	See label for re-entry intervals.
pyrethroid[1] (group 3A)	cypermethrin	Ripcord 400 EC[1]	175 mL/ha (71 mL/acre)	5	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 12-hr re-entry interval.
		UP-Cyde 2.5EC[1]	280 mL/ha (113 mL/acre)	5	
	deltamethrin	Decis 5 EC[1]	250–300 mL/ha (101–121 mL/acre)	5	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves.
	lambda-cyhalothrin	Matador 120EC[1]	83–187 mL/ha (34–76 mL/acre)	1	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 14-day PHI for silage. 24-hr re-entry interval.
		Silencer 120 EC[1]			
	permethrin	Pounce 384EC[1]	275–375 mL/ha (111–152 mL/acre)	1	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 12-hr re-entry interval.
		Perm-UP[1]			
		Ambush 500EC[1]	200–275 mL/ha (81–111 mL/acre)	1	
pyrethroid[1]/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress[1]	500 mL/ha (202 mL/acre)	1	Apply no later than when first feeding is seen on foliage. 24-hr re-entry interval.
spinosyn (group 5)	spinosad	Success	83 mL/ha (34 mL/acre)	7	Use only on very small larvae and low populations. Maintain a spray water pH of 6 or greater. See label for re-entry intervals.
		Entrust	167 mL/ha (67 mL/acre)	7	
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Dipel 2X DF	0.56–1.12 kg/ha (0.22–0.45 kg/acre)	0	Apply when pinhole feeding is observed on 5% of plants. Use high rate on large plants. Apply on a 7-day spray interval.
		Bioprotec CAF	2.8–4 L/ha (1.1–1.6 L/acre)	0	
		Bioprotec 3P	1.45–2 kg/ha (0.59–0.8 kg/acre)	0	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	3	Apply at the first signs of feeding damage. Use high rate for heavy infestations or larger plants. See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Time applications to coincide with peak egg hatch. 12-hr re-entry interval.

[1] Pyrethroid sprays rapidly degrade at temperatures over 26.5°C, and more frequent spray applications are often required. Spraying during cooler evening temperatures may increase the performance of these products.

Table 3–172. Sweet Corn Insect Control — Corn Earworm, Western Bean Cutworm, Fall Armyworm, Armyworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CORN EARWORM					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–4 L/ha (1–1.6 L/acre)	1	No additional information.
	methomyl	Lannate TNG	430–625 g/ha (174–253 g/acre)	3	Apply at 25% green silk. 24-hr re-entry interval.
pyrethroid[1] (group 3A)	cypermethrin	Ripcord 400 EC[1]	175 mL/ha (71 mL/acre)	5	Apply on a 4–7-day schedule based on local pest pressure and crop stage. Target spray to ensure coverage of ears and green silk.
	deltamethrin	Decis 5 EC[1]	250–300 mL/ha (101–121 mL/acre)	5	
	lambda-cyhalothrin	Matador 120EC[1]	83–187 mL/ha (34–76 mL/acre)	1	Apply on a 4–7-day schedule based on local pest pressure and crop stage. Target spray to ensure coverage of ears and green silk. 14-day PHI for silage. 24-hr re-entry interval.
		Silencer 120EC[1]			
	permethrin	Pounce 384EC[1]	275–375 mL/ha (111–152 mL/acre)	1	Apply on a 4–7-day schedule based on local pest pressure and crop stage. Target spray to ensure coverage of ears and green silk. 12-hr re-entry interval.
		Perm-UP[1]			
		Ambush 500EC[1]	200–275 mL/ha (81–111 mL/acre)	1	
pyrethroid[1]/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress[1]	500 mL/ha (202 mL/acre)	1	Apply on a 4–7-day schedule based on local pest pressure and crop stage. Target spray to ensure coverage of ears and green silk. 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Time applications to coincide with peak egg hatch. Target spray to ensure coverage of ears and green silk. 12-hr re-entry interval.
WESTERN BEAN CUTWORM					
pyrethroid[1] (group 3A)	deltamethrin	Decis 5 EC[1]	250–300 mL/ha (101–121 mL/acre)	5	No additional information.
	lambda-cyhalothrin	Matador 120EC[1]	83–187 mL/ha (34–76 mL/acre)	1	14-day PHI for silage. 24-hr re-entry interval.
pyrethroid[1]/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress[1]	500 mL/ha (202 mL/acre)	1	24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Time applications to coincide with peak egg hatch, based on local pest pressure. 12-hr re-entry interval.
FALL ARMYWORM, ARMYWORM					
pyrethroid[1] (group 3A)	lambda-cyhalothrin	Matador 120EC[1]	83–208 mL/ha (34–84 mL/acre)	1	Use low rate for fall armyworm. 14-day PHI for silage. 24-hr re-entry interval.
		Silencer 120 EC[1]	83 mL/ha (34 mL/acre)	1	14-day PHI for silage. 24-hr re-entry interval.
	permethrin	Pounce 384EC[1]	180 mL/ha (73 mL/acre)	1	**Fall armyworm only.** 12-hr re-entry interval.
		Perm-UP[1]			
		Ambush 500EC[1]	140 mL/ha (57 mL/acre)	1	
pyrethroid[1]/diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress[1]	500 mL/ha (202 mL/acre)	1	**Armyworm only.** 24-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	12-hr re-entry interval.

[1] Pyrethroid sprays rapidly degrade at temperatures over 26.5°C, and more frequent spray applications are often required. Spraying during cooler evening temperatures may increase the performance of these products.

Table 3–173. Sweet Corn Insect Control — Brown Marmorated Stink Bug, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	625 g/ha (253 g/acre)	3	**Suppression only.** Apply when insect first appears. See label for re-entry intervals.
APHIDS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	10	Use high rate for heavy infestations. See label for re-entry intervals.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Apply after pollen shed. Apply when aphids are first noticed, before damaging populations become established. DO NOT apply within 50 days of harvest if the crop is being harvested for silage. 12-hr re-entry interval.

SWEET POTATOES

Table 3-174. Sweet Potato Disease Control — Stem Rot, Scurf, Sclerotinia Rot
Table 3-175. Sweet Potato Insect Control — European Chafer Grubs, Flea Beetles, Two-Spotted Spider Mites
Table 3-176. Sweet Potato Insect Control — Aphids, Variegated Cutworm, Armyworm, Slugs
Table 3-177. Sweet Potato Postharvest Disease Control — Bacterial Soft Rot, Fungal Rots

This information is provided as a guideline only. See product labels for complete information.

Table 3–174. Sweet Potato Disease Control — Stem Rot, Scurf, Sclerotinia Rot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STEM ROT, SCURF					
SDHI (group 7)	penthiopyrad	Vertisan	15.5 mL/100 m of row	7	Stem rots caused by *Rhizoctonia solani.* **Suppression only.** Apply in-furrow at planting, in sufficient water to obtain uniform application. See label for rotational crop restrictions. 12-hr re-entry interval.
dithiocarbamate (group M3)	thiram	Thiram 75 WP Granuflo-T	1.75 kg/1,000 L of water	N/A	Apply to roots to be used for slip production. Not for greenhouse use. Dip roots of sprouts for 30 seconds in suspension, then plant promptly.
SCLEROTINIA ROT					
microbial (group 44)	*Bacillus subtilis*	Serenade MAX	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Suppression only.** Begin applications when conditions are conducive to disease development.

Table 3–175. Sweet Potato Insect Control — European Chafer Grubs, Flea Beetles, Two-Spotted Spider Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	clothianidin	Clutch 50WDG	448 g/ha (179 g/acre)	N/A	Apply pre-plant incorporated, prior to transplanting slips. Apply in sufficient water and ensure that transplantation is followed by sufficient irrigation or rainfall to ensure optimal uptake. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 12-hr re-entry interval.
	imidacloprid	Admire 240 F Grapple$_2$ Alias 240 SC	1.2 L/ha (0.5 L/acre)	125	**Reduction in numbers of larvae only.** Apply in 200 L water/ha as a soil drench after transplant and before foliage covers more than 25% of planting bed. Ensure that application is followed by sufficient irrigation or rainfall to ensure optimal uptake. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
FLEA BEETLES					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC Silencer 120 EC	83 mL/ha (33 mL/acre)	7	Apply in a minimum of 100 L water/ha. Will also control potato leafhoppers. Maximum 3 applications/yr. 24-hr re-entry interval.
TWO-SPOTTED SPIDER MITES					
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (200–240 mL/acre)	7	Apply in at least 100 L water/ha. No more than 600 mL/ha can be applied per 7-day interval. Maximum 2 applications/season. See label for rotational crop restrictions. 12-hr re-entry interval. Will also control whiteflies.

Table 3–176. Sweet Potato Insect Control — Aphids, Variegated Cutworm, Armyworm, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Rotate applications with other insecticide groups. Maximum 2 applications/season. See label for rotational crop restrictions. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	Rotate applications with other insecticide groups. Will also control aster leafhopper. Rotate applications with other insecticide groups. Maximum 2 applications/season. See label for rotational crop restrictions. 12-hr re-entry interval or when spray residues have dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	0.12–0.16 kg/ha (0.05–0.06 kg/acre)	7	Maximum 3 applications/yr. Rotate applications with other insecticide groups. See label for rotational crop restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (88–146 mL/acre)	7	Most effective on young stages of aphids. Has slow activity; control may not be apparent for up to 2–3 weeks. No more than 730 mL/ha product can be applied per season. Will also control psyllids and whiteflies. Label directions require a tank mix with a specified spray adjuvant/additive. See label for details. Rotate applications with other insecticide groups. See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (200–600 mL/acre)	7	Use high rate under heavy pest pressure. For optimum control, use a spray adjuvant as stated on the Exirel label. See label for tank-mix and crop tolerance information. Rotate applications with other insecticide groups. See label for rotational crop restrictions. Maximum 4 applications/year. 12-hr re-entry interval.
VARIEGATED CUTWORM, ARMYWORM					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (100–150 mL/acre)	1	Make no more than 2 applications of Group 28 insecticides per generation to the same insect species on a crop. Maximum 4 applications/yr. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	7	See label for tank-mix directions and crop tolerance. Make no more than 2 applications of Group 28 insecticides per generation to the same insect species on a crop. Maximum 4 applications/season. See label for rotational crop restrictions. 12-hr re-entry interval.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	—	Slugs are not usually a problem in established sweet potato fields but under certain conditions may damage newly planted slips. If damage warrants, scatter bait around base of plants and between rows.

Table 3–177. Sweet Potato Postharvest Disease Control — Bacterial Soft Rot, Fungal Rots

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
BACTERIAL SOFT ROT				
inorganic (group M1)	hydrogen peroxide	StorOx	100 mL/10 L water	Spray diluted solution on newly harvested roots. Additional applications can be made daily as a direct injection into humidification water. See product label for details. Do not enter treated areas or storage bins until residues have dried and hydrogen peroxide air concentrations are below mandated safe exposure levels.
FUNGAL ROTS				
phenylpyrrole (group 12)	fludioxonil	Scholar 230SC	473 mL/378 L water	**Rhizopus soft rot only.** Post-harvest drench/dip or overhead application. For best results, uniform coverage is required. See product label for detailed application instructions. Maximum 1 application.
phenylpyrrole/ DMI/QoI (group 12/3/11)	fludioxonil/ difenoconazole/ azoxystrobin	Stadium	32.5 mL/metric tonne	**Rhizopus and fusarium rots only.** Dilute in 2 L water/metric tonne. Post-harvest in-line aqueous spray application. See product label for detailed application instructions. Do not apply to roots that will be used for slip production. Maximum 1 application.
not classified	*Pseudomonas syringae* strain ESC-10	Bio-Save 10LP	500 g/114 L water	**Rhizopus soft rot only.** Post-harvest drench/dip or overhead application. For best results, uniform coverage is required. See product label for detailed application instructions or consult Bio-Save agent.

TOMATOES

In this section:

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Table 3-189. Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite

This information is provided as a guideline only. See product labels for complete information.

Table 3–178. Tomato Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING DISEASE				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg of seed	Seed treatment. **Pythium damping-off. For use in seed treatment plant only.**
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed treatment. **Seed rot, pre-emergence damping-off caused by *Rhizoctonia solani*.** Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting.
phenylpyrrole (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed treatment. **Seed decay, damping-off and seedling blight caused by *Fusarium* and *Rhizoctonia*. For use by commercial seed treaters only.**
dithiocarbamate (group M3)	thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	Seed treatment. **Seed decay, seedling blight, damping-off.**
Soil Treatments				
QiI (group 21)	cyazofamid	Ranman 400SC Torrent 400SC	30 mL in 100 L of water	**Pythium damping-off and root rot.** Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. 60-day pre-harvest interval. 12-hr re-entry interval.
not classified	*Trichoderma harzianum*	RootShield Granules	600–750 g/m³ of loose planting mix or soil	**Suppression only. Root diseases caused by *Pythium, Rhizoctonia, Fusarium*.** 4-hr re-entry interval for greenhouse applications.
		RootShield HC	55–110 g/m³ of loose planting mix or soil or planting beds	**Suppression only. Root diseases caused by *Pythium, Rhizoctonia, Fusarium*.** Potting mix application or drench. 4-hr re-entry interval for greenhouse applications.
phthalimide (group M4)	captan	Maestro 80DF Supra Captan 80 WDG	1.25 kg/1,000 L of water Apply 50–85 L of solution per 100 m².	Soil drench treatment. **Damping-off, fungus root rot.** 48-hr re-entry interval.
BOTRYTIS GRAY MOLD, POWDERY MILDEW				
hydroxyanilide (group 17)	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.61 kg/acre)	**Botrytis gray mold.** 60-day pre-harvest interval. 4-hr re-entry interval.
not classified	*Streptomyces lydicus*	Actinovate SP	425–840 g/700 L of water Spray to wet, but avoid runoff. Select a water volume that will ensure thorough, uniform coverage of the plants.	**Powdery mildew. Suppression.** 1-hr re-entry interval.
	Trichoderma harzianum	RootShield HC	3.75–7.5 g/1 L of water Spray to wet, but avoid runoff. Use quantity of spray solution to thoroughly cover foliage.	**Botrytis gray mold. Suppression.** Foliar application. 4-hr re-entry interval.
BACTERIAL DISEASES				
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.91 kg/acre)	**Bacterial spot.** Apply every 5 days, when warranted, to a maximum of 5 applications over a 4-week period prior to transplanting. Apply in low water volumes. 24-hr re-entry interval.
		Kocide 2000	3.2 kg/ha (1.3 kg/acre)	**Bacterial spot.** Apply every 5 days, when warranted, to a maximum of 5 applications over a 4-week period prior to transplanting. Apply in low water volumes. 24-hr re-entry interval.
INSECTS				
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec 3P	0.8 kg/1,000 L of water Use quantity of spray solution to achieve sufficient coverage.	***Duponchelia fovealis.*** Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary.
not classified	*Beauveria bassiana*	BotaniGard 22WP	250–500 g/400 L of water Spray to wet, but avoid runoff.	**Whiteflies, aphids.** 4-hr re-entry interval.
			500–1,000 g/400 L of water Spray to wet, but avoid runoff.	**Thrips.** 4-hr re-entry interval.

Table 3–179. Activity of Fungicides on Tomato Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

		Greenhouse (Transplants)					Field								
Common Name	**Trade Name**	**Damping-Off (Seedlings)**	**Root Disease**	**Botrytis Gray Mold**	**Powdery Mildew**	**Bacterial Spot**	**Anthracnose**	**Bacterial Disease**[1]	**Early Blight**	**Botrytis Gray Mold**	**Late Blight**	**Phytophthora Blight**	**Powdery Mildew**	**Septoria Leaf Spot**	**Sclerotinia White Mold**
difenoconazole	Inspire	—	—	—	—	—	C	—	C	—	—	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	—	C	—	C	—	—	—	C	C	—
boscalid	Cantus WDG	—	—	—	—	—	—	—	C	C	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	—	—	S	C	—	—	—	—	—
pyrimethanil	Scala SC	—	—	—	—	—	—	—	C	C	—	—	—	—	—
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	—	—	—	C	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	—	C	—	C	—	—	—	—	—	—
fenamidone	Reason 500SC	—	—	—	—	—	—	—	C	—	C	—	—	—	—
pyraclostrobin	Cabrio EG	—	—	—	—	—	C	—	C	—	C	—	—	C	—
famoxadone/cymoxanil	Tanos 50 DF	—	—	—	—	—		—	C	—	C	—	—	—	—
fenhexamid	Decree 50 WDG	—	—	C	—	—	—	—	—	—	—	—	—	—	—
cyazofamid	Ranman 400SC	C	C	—	—	—	—	—	—	—	C	—	—	—	—
	Torrent 400SC	C	C	—	—	—	—	—	—	—	C	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	S	—	—	—	—	—	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	—	—	—	—	—	—	—	—	S	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	—	—	—	S	S[1]	—	—	—
dimethomorph	Acrobat 50 WP	—	—	—	—	—	—	—	—	—	C	—	—	—	—
mandipropamid	Revus	—	—	—	—	—	—	—	—	—	C	—	—	—	—
amectotradin/dimethomorph	Zampro	—	—	—	—	—	—	—	—	—	C	S	—	—	—
fluopicolide	Presidio	—	—	—	—	—	—	—	—	—	C	—	—	—	—
Bacillus subtilis	Serenade ASO	—	—	—	—	—	—	S	S	S	—	—	S	—	—
Coniothyrium minitans	Contans WG	—	—	—	—	—	—	—	—	—	—	—	—	—	S
copper hydroxide	Coppercide WP	—	—	—	—	C	—	C	—	—	—	—	—	—	—
	Kocide 2000	—	—	—	—	C	—	C	C	—	C	—	—	C	—
	Parasol WG	—	—	—	—	—	—	C	—	—	—	—	—	—	—
copper oxychloride	Copper Spray	—	—	—	—	—	—	—	C	—	C	—	—	C	—
copper sulphate	Copper 53W	—	—	—	—	—	C	—	C	—	C	—	—	C	—
mancozeb	Dithane Rainshield	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Manzate Pro-Stick	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Penncozeb 75DF Raincoat	—	—	—	—	—	C	—	C	—	C	—	—	—	—
metiram	Polyram DF	—	—	—	—	—	C	—	C	—	C	—	—	C	—
captan	Maestro 80DF	C	C	—	—	—	C	—	—	—	—	—	—	C	—
	Supra Captan 80 WDG	C	C	—	—	—	C	—	—	—	—	—	—	C	—
folpet	Folpan 80 WDG	—	—	—	—	—	C	—	—	—	—	—	—	—	—
chlorothalonil	Bravo 500	—	—	—	—	—	C	—	C	C	C	—	—	C	—
	Echo 90DF	—	—	—	—	—	C	—	C	C	C	—	—	C	—
citric and lactic acid	Tivano	—	—	—	—	—	—	S	—	—	—	—	—	—	—
potassium bicarbonate	MilStop	—	—	—	C	—	—	—	—	—	—	—	—	—	—
acibenzolar-S-methyl	Actigard 50WG	—	—	—	—	—	—	S	—	—	—	—	—	—	—
extract of *Reynoutria sachalinensis*	Regalia Maxx	—	—	—	—	—	—	S	—	S	—	—	—	—	—
Streptomyces lydicus	Actinovate SP	—	—	—	S	—	—	—	—	—	—	—	S	—	—
Trichoderma harzianum	RootShield Granules	—	S	—	—	—	—	—	—	—	—	—	—	—	—
	RootShield HC	—	S	S	—	—	—	—	—	S	—	—	—	—	—

[1] See label for details.

Table 3–180. Tomato Bacterial Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
antibiotic (group 24)	kasugamycin	Kasumin 2L	1.2 L/ha (0.5 L/acre)	1	**Bacterial canker, bacterial spot. Suppression only.** Spray volume must be sufficient to provide good coverage of treated foliage. May be tank-mixed with Kocide. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–15 L/ha (1.6–6 L/acre)	0	**Bacterial spot. Suppression only.** Begin applications soon after transplant. Repeat as necessary on a 7–10-day interval. When conditions are conducive to rapid disease development, use in a rotational program with other bactericides.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.9 kg/acre)	1	**Bacterial spot.** Apply 7 days after transplanting and repeat at 7-day intervals for at least 3 applications. Apply more frequently under wet conditions. If wet conditions persist, continue applications until early bloom. 24-hr re-entry interval.
		Kocide 2000	2.52–3.2 kg/ha (1.02-1.3 kg/acre)	1	**Bacterial canker, bacterial spot.** Apply 7 days after transplanting and repeat at 7-day intervals for at least 3 applications. Apply more frequently under wet conditions. If wet conditions persist, continue applications until early bloom. 48-hr re-entry interval.
		Parasol WG	2.25 kg/ha (0.9 kg/acre)	1	**Bacterial spot.** Apply 7 days after transplanting and repeat at 7-day intervals for at least 3 applications. Apply more frequently under wet conditions. If wet conditions persist, continue applications until early bloom. 48-hr re-entry interval.
not classified	citric and lactic acid	Tivano	12 L/ha (4.9 L/acre)	0	**Bacterial canker. Suppression only.** Begin applications when conditions are conducive to disease development. Surfactants listed on label can be used to obtain better coverage. Re-entry permitted once spray deposit has dried.
benzo-thiadiazole — host plant defence induction (group P1)	acibenzolar-S-methyl	Actigard 50 WG	25 g/ha (10 g/acre)	14	**Bacterial speck, bacterial spot. Suppression only.** Begin applications within 1 week of transplanting. Make up to 8 weekly sequential applications. Do not apply on less than 7-day interval. Apply Actigard 50WG to healthy, actively growing plants. Do not apply Actigard 50WG to plants that are stressed due to drought, excessive moisture, cold weather or herbicide injury. See label for recropping restrictions. 12-hr re-entry interval.
plant extract (group P5)	extract of *Reynoutria sachalinensis*	Regalia Maxx	0.125%–0.25% v/v in 500–1,000 L water/ha (0.125%–0.25% v/v in 200–400 L water/acre)	0	**Bacterial spot. Suppression only.** Repeat applications at 7–10-day intervals depending upon crop growth and disease pressure. When environmental conditions and plant stage are conducive to rapid disease development, use in a rotational program with other registered fungicides. Re-entry permitted once spray deposit has dried.

Table 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leafspot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); a.i. = active ingredient

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT					
DMI (group 3)	difenoconazole	Inspire	292–512 mL/ha (118–207 mL/acre)	0	**Anthracnose and early blight.** Use high rate for anthracnose control. Do not use on varieties in which the mature tomatoes will be less than 5 cm (such as cherry tomatoes). See label for recropping restrictions. 12-hr re-entry interval.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	**Early blight.** See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	**Early blight. Suppression only.** See label for rotational crop restrictions. 12-hr re-entry interval.
anilino-pyrimidines + chloronitrile (group 9 + M5)	pyrimethanil + chlorothalonil	Scala SC + Bravo 500	750 mL/ha + 2.4–4.0 L/ha (304 mL/acre + 1.0–1.6 L/acre)	1	**Early blight (Scala). Anthracnose, early blight, late blight, septoria leaf spot (Bravo).** See label for recropping restrictions. 48-hr re-entry interval (Bravo 500).
QoI (group 11)	azoxystrobin	Quadris Flowable	300–500 mL/ha (121–202 mL/acre)	1	**Early blight, anthracnose.** Do not apply for 21 days after transplanting. Do not apply for 6 days before or after using metribuzin. See label for recropping restrictions. 12-hr re-entry interval.
QoI + dithiocarbamate (group 11 + M3)	fenamidone + mancozeb	Reason 500SC + mancozeb	200 mL/ha + 935 g a.i./ha (81 mL/acre + 378 g a.i./acre)	14	**Early blight, late blight (Reason). Anthracnose, early blight, late blight (mancozeb).** Tank-mix with mancozeb or Bravo 500. See label for recropping restrictions. 12-hr re-entry interval.
QoI + chloronitrile (group 11 + M5)	fenamidone + chlorothalonil	Reason 500SC + Bravo 500	200 mL/ha + 2.4–4 L/ha (81 mL/acre + 1.0–1.6 L/acre)	14	**Early blight, late blight (Reason). Anthracnose, early blight, late blight, septoria leaf spot (Bravo).** Tank-mix with mancozeb or Bravo 500. See label for recropping restrictions. 12-hr re-entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	**Anthracnose, early blight, septoria leaf spot.** See label for recropping restrictions. 12-hr re-entry interval.
			560–1,000 g/ha (227–405 g/acre)	0	**Late blight.** See label for recropping restrictions. 12-hr re-entry interval.
QoI/ DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	**Anthracnose, early blight, septoria leaf spot.** Do not apply until 21 days after transplanting or 35 days after seeding. Do not apply 6 days before or after metribuzin. See label for recropping restrictions. 12-hr re-entry interval.
QoI/ cyanoacetamide oxime (group 11/27)	famoxadone/ cymoxanil	Tanos 50 DF	560 g/ha (227 g/acre)	3	**Early blight and late blight.** See label for rotational crop restrictions. 12-hr re-entry interval.
QiI (group 21)	cyazofamid	Ranman 400SC	0.1–0.2 L/ha (0.04–0.08 L/acre)	1	**Late blight.** Tank-mix with non-ionic or organosilicone surfactant; see label for directions. See label for recropping restrictions. 12-hr re-entry interval.
		Torrent 400SC	0.1–0.2 L/ha (0.04–0.08 L/acre)	1	**Late blight.** Tank-mix with non-ionic or organosilicone surfactant; see label for directions. See label for recropping restrictions. 12-hr re-entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.17–2.35 L/acre)	0	**Late blight. Suppression only.** 12-hr re-entry interval.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2.0–4.1 L/acre)	1	**Late blight. Suppression only.** May be applied as foliar sprays or through sprinkler chemigation.

Table 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leafspot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); a.i. = active ingredient

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT (cont'd)					
carboxylic acid amides (group 40)	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	**Late blight.** Follow label instructions regarding use of a non-ionic surfactant. A tank mix with Bravo is suggested for resistance management. See label for recropping restrictions. 12-hr re-entry interval.
	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	**Late blight.** Label directions require a tank mix with another fungicide with activity against late blight. See label for recropping restrictions. 12-hr re-entry interval.
benzamide + chloronitrile (group 43 + M5)	fluopicolide + chlorothalonil	Presidio + Bravo 500	220–292 mL/ha + 2.4–4.0 L/ha (89–118 mL/acre + 1.0–1.6 L/acre)	2	**Late blight (Presidio). Anthracnose, early blight, late blight, septoria leaf spot (Bravo).** Label directions require a tank mix with Bravo 500 when targetting late blight. Do not make sequential applications. See label for rotational crop restrictions. 48-hr re-entry interval (Bravo 500).
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	8–15 L/ha (3.2–6.1 L/acre)	0	**Early blight. Suppression only.**
QxI/ carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	**Late blight.** Begin applications prior to disease development. Follow label instructions regarding adding a spreading/penetrating adjuvant to improve performance. See label for recropping restrictions. 12-hr re-entry interval.
inorganic (group M1)	copper oxychloride	Copper Spray	4.0 kg/ha (1.62 kg/acre)	1	**Early blight, late blight, septoria leaf spot.** 48-hr re-entry interval.
	copper sulphate	Copper 53W	4.5 kg/ha (1.8 kg/acre)	1	**Anthracnose, early blight, late blight, septoria leaf spot.** 48-hr re-entry interval.
	copper hydroxide	Kocide 2000	2.52 kg/ha (1.0 kg/acre)	1	**Early blight, late blight, septoria.** Should be combined with 1.75–2.25 kg/ha mancozeb (80% active). 48-hr re-entry interval.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.45–1.32 kg/acre)	7	**Anthracnose, early blight, late blight.**
		Manzate Pro-Stick	1.75–3.25 kg/ha (0.71–1.32 kg/acre)	7	**Anthracnose, early blight, late blight.** 24-hr re-entry interval.
		Penncozeb 75DF Raincoat	1.1–3.25 kg/ha (0.45–1.32 kg/acre)	7	**Anthracnose, early blight, late blight.** 24-hr re-entry interval.
	metiram	Polyram DF	2.25 kg/ha (0.91 kg/acre)	7	**Early blight, late blight.**
			3.25 kg/ha (1.32 kg/acre)	7	**Anthracnose, septoria leaf spot.**
phthalimide (group M4)	captan	Maestro 80DF	2.75–4.25 kg/ha (1.11–1.72 kg/acre)	2	**Anthracnose, septoria leaf spot.** 48-hr re-entry interval.
	captan	Supra Captan 80 WDG	2.75–4.25 kg/ha (1.11–1.72 kg/acre)	2	**Anthracnose, septoria leaf spot.** 48-hr re-entry interval.
	folpet	Folpan 80 WDG	5 kg/ha (2 kg/acre)	1	**Anthracnose.** 24-hr re-entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo 500	2.4–4.0 L/ha (1.0–1.6 L/acre)	1	**Anthracnose, early blight, late blight, septoria leaf spot.** 48-hr re-entry interval.
		Echo 90DF	1.3–2.2 kg/ha (0.5–0.9 kg/acre)	1	**Anthracnose, early blight, late blight, septoria leaf spot.** 48-hr re-entry interval.

Table 3–182. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD, SCLEROTINIA WHITE MOLD					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	**Botrytis gray mold.** See label for recropping restrictions. 12-hr re-entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	**Botrytis gray mold.** See label for rotational crop restrictions. 12-hr re-entry interval.
anilino-pyrimindine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	**Botrytis gray mold.** See label for recropping restrictions. 12-hr re-entry interval.
anilino-pyrimidines + chloronitrile (group 9 + M5)	pyrimethanil + chlorothalonil	Scala SC + Bravo 500	750 mL/ha + 2.4–4.0 L/ha (304 mL/acre + 1.0–1.6 L/acre)	1	**Botrytis gray mold.** See label for recropping restrictions. 48-hr re-entry interval.
not classified	*Coniothyrium minitans*	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	**Sclerotinia white mold. Suppression only.** Apply to soil prior to or at planting or at time of transplant at least 3 months prior to typical onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre).
	Trichoderma harzianum	RootShield HC	3.75–7.5 g/L of water Spray to wet, but avoid runoff.	0	**Botrytis gray mold. Suppression only.** Foliar application. 4-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	4–15 L/ha (1.6–6.1 L/acre)	0	**Botrytis gray mold. Suppression only.**
chloronitrile (group M5)	chlorothalonil	Bravo 500	4.8 L/ha (1.9 L/acre)	1	**Botrytis gray mold.** 48-hr re-entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	**Botrytis gray mold.** 48-hr re-entry interval.
plant extract (group P5)	extract of *Reynoutria sachalinensis*	Regalia Maxx	0.25% v/v in 500–1,000 L water/ha (0.25% v/v in 200–400 L water/acre)	0	**Botrytis gray mold. Suppression only.** Repeat applications at 7–10-day intervals depending upon crop growth and disease pressure. When environmental conditions and plant stage are conducive to rapid disease development, use in a rotational program with other registered fungicides. Re-entry permitted once spray deposit has dried.

Table 3–183. Tomato Fungal Disease Control — Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	**Phytophthora foliar blight. Suppression only.** May be applied as foliar sprays or through sprinkler chemigation. 12-hr re-entry interval.
QxI/ carboxylic acid amide (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	**Phytophthora foliar blight. Suppression only.** If products from other fungicide groups are not available for rotation, apply only 1 spray/season, applied preventively before symptoms appear and when the risk of disease is high. Follow label instructions regarding adding a spreading/penetrating adjuvant to improve performance. See label for recropping restrictions. 12-hr re-entry interval.
POWDERY MILDEW					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting or 35 days after seeding. Do not apply 6 days before or after metribuzin. See label for recropping restrictions. 12-hr re-entry interval.
microbial (group 44)	*Bacillus subtilis*	Serenade ASO	5–15 L/ha (2–6 L/acre)	0	**Suppression only.**
not classified	*Streptomyces lydicus*	Actinovate SP	425–840 g in 700 L water/ha (172–340 g in 280 L water/acre)	0	**Suppression only.** Spray to wet, but avoid runoff. Re-entry permitted once spray deposit has dried.

Table 3–184. Activity of Insecticides on Tomato Insects

LEGEND: C = control
RD = reduction in damage
S = suppression
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (transplant)		Field												
		Duponchelia fovealis	Whitefly, Aphids, Thrips	Aphids	Cabbage Looper	Colorado Potato Beetle	Cutworms (Early-Season or Climbing)	Drosophila	Flea Beetle	Hornworm	Mites	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug	Tomato Fruitworm	Wireworm
carbaryl	Sevin XLR	—	—	—	—	N	C	—	C	C	—	N	—	C	C	—
methomyl	Lannate Toss-N-Go	—	—	C	—	—	C	—	—	—	—	—	S	—	C	—
acephate	Orthene 75% SP	—	—	C	—	N	C	—	C	—	—	—	—	—	—	C
dimethoate	Cygon 480	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—
	Lagon 480 E	—	—	C	—	—	—	—	—	—	—	—	—	C	—	—
malathion	Malathion 25W	—	—	N	—	N	—	—	—	—	N	—	—	—	—	—
	Malathion 85E	—	—	N	—	—	—	—	—	—	N	—	S	—	—	—
naled	Dibrom	—	—	—	—	—	—	C	—	C	—	—	—	—	C	—
endosulfan	Thionex EC	—	—	C	—	C	—	—	C	C	—	—	—	—	C	—
cypermethrin	Ripcord 400 EC	—	—	—	—	C	—	—	C	—	—	—	—	—	—	—
	UP-Cyde 2.5 EC	—	—	—	—	C	—	—	C	—	—	—	—	—	—	—
deltamethrin	Decis 5 EC	—	—	—	—	C	—	—	—	—	—	—	—	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	C	C	—	C	—	—	—	—	C	—	—
	Silencer 120 EC	—	—	—	—	C	C	—	C	—	—	—	—	C	—	—
permethrin	Ambush 500EC	—	—	—	—	C	C	—	C	C	—	—	—	—	C	—
	Perm-UP	—	—	—	—	C	C	—	C	C	—	—	—	—	C	—
	Pounce 384EC	—	—	—	—	C	C	—	C	C	—	—	—	—	C	—
imidacloprid/deltamethrin	Concept	—	—	—	—	C	—	—	—	C	—	—	—	—	—	—
acetamiprid	Assail 70 WP	—	—	C	—	C	—	—	—	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	C[1]	—	C[1]	—	—	—	—	—	—	—	—	—	—
	Alias 240 SC	—	—	—	—	C	—	—	—	—	—	—	—	—	—	—
	Grapple$_2$	—	—	—	—	C	—	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	—	—	C	—	C	—	—	S	—	—	—	—	—	—	—
	Actara 25WG	—	—	C	—	—	—	—	—	—	—	C[1]	RD	C[1]	—	—
spinetoram	Delegate WG	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	—	C	C	—	—	—	—	—	—	—	—	—	—
	Success	—	—	—	C	C	—	—	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—
Bacillus thuringiensis	Bioprotec 3P	C	—	—	C	—	—	—	—	C	—	—	—	—	C	—
	Bioprotec CAF	C	—	—	C	—	—	—	—	C	—	—	—	—	C	—
	Dipel 2X DF	—	—	—	C	—	—	—	—	C	—	—	—	—	C	—
	Thuricide HPC	—	—	—	C	—	—	—	—	C	—	—	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	C	—	—	—	—	—	—	—	—	—	—	—
spiromesifen	Oberon Flowable	—	—	—	—	—	—	—	—	—	C	—	—	—	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—	—	—	—	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	C	C	—	—	C	—	—	—	—	C	—
cyantraniliprole	Exirel	—	—	C	C	C	C	—	—	S	—	—	—	—	C	—
Beauveria bassiana	BotaniGard 22WP	—	C	—	—	—	—	—	—	—	—	—	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	—	—	—	—	—	C	—	—	—	—	—

[1] See label for details.

Table 3–185. Tomato Insect Control — Aphids, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Treatment					
organophosphate (group 1B)	acephate	Orthene 75 SP	900 g in 2,000 L water/ha (364 g in 810 L water/acre)	—	Transplant water application. Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240F	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
Foliar Treatment					
carbamate (group 1A)	methomyl	Lannate TNG	270–540 g/ha (109–219 g/acre)	1	12-hr re-entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	0.55–1.1 L/ha (0.22–0.45 L/acre)	7	No additional information.
		Lagon 480 E			
	malathion	Malathion 25 W	2.75–4.25 kg/ha (1.11–1.72 kg/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas.
cyclodiene organochlorine (group 2A)	endosulfan	Thionex EC	1.5–2.5 L/ha (0.61–1.0 L/acre)	27	4-day re-entry interval.

Table 3–185. Tomato Insect Control — Aphids, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS (cont'd)					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for recropping restrictions. 12-hr re-entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Label directions require a tank mix with a specified spray adjuvant/additive. See label for recropping restrictions. 12-hr re-entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	For optimum control of aphids, follow label instructions regarding use of a spray adjuvant as recommended on the Exirel label. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	45 mL/100 m of row (14 mL/100 ft of row)	2	Apply in 25–30-cm band over row.
	methomyl	Lannate TNG	270–540 g/ha (109–219 g/acre)	1	12-hr re-entry interval.
organophosphate (group 1B)	acephate	Orthene 75 SP	900 g in 2,000 L water/ha (364 g in 810 L water/acre)		Transplant water treatment. Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr re-entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Apply in the late evening or at night. Do not disturb the soil for 5 days after application. 24-hr re-entry interval.
		Silencer 120 EC			
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	See label for application instructions. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	See label for application instructions. 12-hr re-entry interval.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	1	See label for application instructions. Re-entry permitted once spray deposit has dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–186. Tomato Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
Transplant or Soil Treatments					
organophosphate (group 1B)	acephate	Orthene 75 SP	900 g in 2,000 L water/ha (364 g in 810 L water/acre)	—	Transplant water application. Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr re-entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	—	See label for soil application options. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Alias 240 SC	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)	—	Apply in-furrow at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Grapple$_2$			
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Apply in-furrow at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–186. Tomato Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE (cont'd)					
Foliar Treatments					
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	85 mL/ha (34 mL/acre)	3	No additional information.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	3	12-hr re-entry interval.
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	3	Do not apply after August 1.
	lambda-cyhalothrin	Matador 120EC	83–125 mL/ha (34–51 mL/acre)	7	24-hr re-entry interval.
		Silencer 120 EC			
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr re-entry interval.
		Pounce 384EC			Re-entry permitted once spray deposit has dried.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	40–80 g/ha (16–32 g/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. 12-hr re-entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Follow label instructions regarding the use of imidacloprid in areas treated with the product in the previous season. See label for rotational crop restrictions. 24-hr re-entry interval.
		Alias 240 SC			
		Grapple$_2$			
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Use only on small larvae and low infestations. Maintain a spray water pH of 6 or greater. Re-entry permitted once spray deposit has dried.
		Success	83 mL/ha (34 mL/acre)	1	Use only on small larvae and low infestations. Maintain a spray water pH of 6 or greater. Re-entry permitted once spray deposit has dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (304–405 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–187. Tomato Insect Control — Cabbage Looper, Tomato or Tobacco Hornworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
spinosyn (group 5)	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	Application should coincide with peak egg hatch. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	Apply at first signs of infestation when larvae are small.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)		
		Thuricide HPC	2.0–4.25 L/ha (0.8–1.7 L/acre)		
diacylhydrazines (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Acts primarily through ingestion by larvae. See label for rotational crop restrictions. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Early application on larval stages provides best control. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.
HORNWORM, TOMATO OR TOBACCO					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1.0–2.1 L/acre)	2	No additional information.
cyclodiene organochlorines (group 2A)	endosulfan	Thionex EC	1.5–2.5 L/ha (0.6–1.0 L/acre)	27	4-day re-entry interval.
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr re-entry interval.
		Pounce 384 EC	180–260 mL/ha (73–105 mL/acre)	1	Re-entry permitted once spray deposit has dried.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
biological (group 11)	*Bacillus thuringiensis* subsp. *kurstaki*	Bioprotec CAF	0.65–1.1 L/ha (0.26–0.45 L/acre)	0	Apply at first signs of infestation when larvae are small.
		Dipel 2X DF	140–275 g/ha (57–111 g/acre)		
		Thuricide HPC	0.75–1.5 L/ha (0.3–0.6 L/acre)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 12-hr re-entry interval.
	cyantraniliprole	Exirel	750 mL/ha (304 mL/acre)	1	**Suppression only.** Early application on larval stages provides best results. See label for tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–188. Tomato Insect Control — Stink Bug, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	No additional information.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Rotate applications with other insecticide groups. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
BROWN MARMORATED STINK BUG See the OMAF website for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	540 g/ha (219 g/acre)	1	**Suppression only.** 12-hr re-entry interval.
organophosphate (group 1B)	malathion	Malathion 85E	975 mL/ha (395 mL/acre)	3	**Suppression only.**
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	**Reduction in damage only.** Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.

Table 3–189. Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	No additional information.
organophosphate (group 1B)	dimethoate	Lagon 480 E	0.55–1.1 L/ha (0.22–0.45 L/acre)	7	No additional information.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	24-hr re-entry interval.
		Silencer 120 EC			
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL per plant in transplant water.	30	**Suppression only.** Transplant water application. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			3.4–4.4 g/100 m of row 1.0–1.3 g/100 ft of row	30	**Suppression only.** In-furrow application at transplanting. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
			105–210 g/ha (42–85 g/acre)	1	Rotate applications with other insecticide groups. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. 12-hr re-entry interval.
TWO-SPOTTED SPIDER MITE					
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. See label for rotational crop restrictions. 12-hr re-entry interval.
bifenazate (group UN)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr re-entry interval.

TURNIPS

In this section:

Table 3–190. Turnip Seed Treatments
Table 3–191. Activity of Fungicides and Insecticides on Turnip Diseases and Insects
Table 3–192. Turnip Disease Control
Table 3–193. Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms
Table 3–194. Turnip Insect Control — Aphids, European Chafer Grubs, Swede Midge

This information is provided as a guideline only. See product labels for complete information.

Table 3–190. Turnip Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S	20–40 mL/ 100 kg seed	damping-off (*Pythium*)	**For use in commercial seed-treatment plants only.**
Thiram 75 WP	thiram	90 g/ 25 kg seed	seed decay and damping-off	Seed box treatment.
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	damping off (*Rhizoctonia*)	**For import use only.** Not for domestic commercial or on-farm seed treatment.

Table 3–191. Activity of Fungicides and Insecticides on Turnip Diseases and Insects

LEGEND: C = control
RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Alternaria	Powdery Mildew	Cercospora	Rhizoctonia	Botrytis Gray Mold	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Aphids	European Chafer Grubs	Swede Midge
Fungicides													
metalaxyl-M and S	Apron XL LS	C	—	—	—	—	—	—	—	—	—	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—	—	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	—	C	C	C	—	—	—	—	—	—	—	—
trifloxystrobin	Flint	—	C	—	—	—	—	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	C	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C	—	—	—	—	—	—
Insecticides													
carbaryl	Sevin XLR	—	—	—	—	—	—	C	C[1]	—	—	—	—
cypermethrin	Ripcord 400 EC	—	—	—	—	—	—	C	—	—	—	—	—
	UP-Cyde 2.5 EC	—	—	—	—	—	—	C	—	—	—	—	—
permethrin	Pounce 384EC	—	—	—	—	—	—	C	—	—	—	—	—
	Perm-UP	—	—	—	—	—	—	C	—	—	—	—	—
	Ambush 500EC	—	—	—	—	—	—	C	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	—	C	—	—	C	RD	—
malathion	Malathion 85E	—	—	—	—	—	—	—	C[2]	—	N	—	—
spinosad	Success	—	—	—	—	—	—	—	C	—	—	—	—
	Entrust	—	—	—	—	—	—	—	C	—	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	—	C	C	—	—	C
thiamethoxam	Actara 25WG	—	—	—	—	—	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	—	—	—	—	—	C	—	—
flonicamid	Beleaf 50SG	—	—	—	—	—	—	—	—	—	C	—	—

[1] For control of imported cabbageworm and diamondback moth only.
[2] For control of imported cabbageworm and cabbage loopers only.

Table 3–192. Turnip Disease Control

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA					
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand-harveting. 12-hr re-entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Use higher rate and shorter spray interval when disease pressure is high. When possible, rotate with fungicides with a different mode of action, otherwise avoid consecutive applications of Group 11 fungicides. See label for recropping restrictions. Maximum 4 applications/season. 12-hr re-entry interval.
POWDERY MILDEW, CERCOSPORA					
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	3	Do not use more than 2 applications before rotating to a different fungicide group. See label for recropping restrictions. Maximum 3 applications/season. 3-day re-entry interval for hand-harvesting. 12-hr re-entry interval for all other activities.
RHIZOCTONIA					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	Maximum 1 application/yr; applied in-furrow at planting or banded soon after emergence. See label for recropping restrictions. 12-hr re-entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Apply no more than 4.5 L/ha/season. 12-hr re-entry interval.
anilino-pyramidine/ phenylpyrrole (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval.

Table 3–193. Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	No additional information.
pyrethroid (group 3A)	cypermethrin	Ripcord 400 EC	123 mL/ha (49 mL/acre)	21	No additional information.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	21	12-hr re-entry interval.
	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	—	12-hr re-entry interval.
		Perm-UP			
		Ambush 500EC	140 mL/ha (57 mL/acre)	—	
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
LEAF-EATING CATERPILLARS (IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH)					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	**Imported cabbage worm and diamondback moth only.**
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	**Imported cabbageworm and cabbage loopers only.** Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
spinosyn (group 5)	spinosad	Success	182 mL/ha (73 mL/acre)	3	Maintain a spray pH of 6 or higher. Maximum 3 applications/yr. Re-entry permitted once spray deposit has dried.
		Entrust	364 mL/ha (147 mL/acre)	3	
	spinetoram	Delegate WG	140–200 g/ha (56–81 g/acre)	3	Use the higher rate for high infestations or advanced growth stages of the target pest. Maximum 3 applications/yr. 12-hr re-entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use high rate under heavy pest pressure. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.
			250 mL/ha (101 mL/acre)	1	Black cutworm. Maximum 4 applications/season. Do not exceed 1.125 L/ha/season. 12-hr re-entry interval.

Table 3–194. Turnip Insect Control — Aphids, European Chafer Grubs, Swede Midge

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage, repeat as necessary. Apply when temperature is at or above 20°C.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Soil application. Also controls leafhoppers. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
			200 mL/ha (81 mL/acre)	7	Foliar application. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 2 applications/ season. 24-hr re-entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Apply before pests reach damaging levels. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. See label for rotational crop restrictions. Maximum 2 applications/season. 12-hr re-entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	See label for recropping restrictions. Maximum 2 applications/season. 12-hr re-entry interval or re-entry permitted once spray deposit has dried.
flonicamid (group 9C)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Thorough spray coverage is essential for optimum control. Use higher rates for greater pest populations and/or dense foliage. See label for recropping restrictions. Maximum 3 applications/yr. 12-hr re-entry interval.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	**Reduction in numbers of larvae only.** Soil application, field drench. See label for application details. Do not apply foliar group 4 insecticides (neonicotinoids) in the same season as an in-furrow or soil application. Imidacloprid should not be used in areas treated with the product in the previous season. See label for rotational crop restrictions. Maximum 1 application/season. 24-hr re-entry interval.
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	When possible, rotate with other products registered for Swede midge control, otherwise avoid sequential applications for resistance management. 12-hr re-entry interval.

4. Pesticides Used on Vegetable Crops in Ontario

In this section:

Table 4-1. Pesticides Used on Vegetable Crops in Ontario
Table 4-2. Pest Control Product Companies
Table 4-3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops
Table 4-4. Pesticides Used in Vegetable Crops That Affect Cholinesterase Levels in Blood

The information is provided as a guideline only. Consult each product label before use for most up-to-date information.

Table 4–1. Pesticides Used on Vegetable Crops in Ontario

USE CODES:
a = acaricide
b = bactericide
cp = crop protectant
f = fungicide
h = herbicide
i = insecticide
m = miticide
n = nematicide
pgr = plant growth regulator
r = rodenticide
s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
abamectin	*See AGRI-MEK*						
ACAPELA	picoxystrobin	30470	f	250 g/L	4	sweet corn	DUQ
acephate	*See ORTHENE*						
acequinocyl	*See KANEMITE*						
acetamiprid	*See ASSAIL*						
acibenzolar-S-methyl	*See ACTIGARD*						
ACRAMITE 50WS	bifenazate	27925	m	50	4	eggplant, peppers, tomatoes	CRE
ACROBAT 50 WP	dimethomorph	27700	f	50	3	brassica crops (see label), garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peppers, potatoes, tomatoes	BAZ
ACTARA 240SC	thiamethoxam	28407	i	240 g/L	3	brassica crops (see label), celery, cucurbits (vine crops), eggplant, parsley, lettuce (head and leaf), endive, peppers, potatoes, spinach, tomatoes	SYZ

[1] Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Ministry of Agriculture and Food, nor that these products are approved to the exclusion of comparable products. All trade names are capitalized.

[2] See the pesticide label to confirm the current product registration number (PCP#).

[3] The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOE the classification of pesticide products before they can be sold or used in Ontario. Most pesticides used in vegetable crops are either a Class 2, 3 or 4. Users of Class 2 and 3 products must be certified through the Grower Pesticide Safety Course.
Class 2: Restricted or commercial use only; very hazardous and/or persistent
Class 3: Restricted or commercial use only; moderately hazardous and/or moderately persistent
Class 4: Restricted or commercial use only; less or least hazardous and/or low persistence

[4] See *Table 4-2. Pest Control Product Companies*, on page 253.

Table 4–1. Pesticides Used on Vegetable Crops in Ontario

USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide
m = miticide n = nematicide pgr = plant growth regulator r = rodenticide s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
ACTARA 25WG	thiamethoxam	28408	i	25	3	beets (table), carrots, celery, eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rutabagas, spinach, Swiss chard, sweet potatoes, tomatoes, turnips	SYZ
ACTIGARD 50WG	acibenzolar-S-methyl	29756	pgr/f	50	4	tomatoes	SYZ
ACTINOVATE SP	*Streptomyces lydicus*	28672	f	1.0 x 10^7 CFU/g	4	peppers, tomatoes	MHI
ADMIRE 240 F	imidacloprid	24094	i	240 g/L	4	beans, beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, herbs (see label), parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rutabagas, spinach, Swiss chard, sweet potatoes, tomatoes, turnips	BCZ
AGRI-MEK 1.9% EC	abamectin	24551	i	19 g/L	3	celery, garlic, onions (dry bulb), shallots, potatoes	SYZ
AGROX B-2	diazinon/ captan	26956	s	11/ 33.5	3	beans, peas, sweet corn	NRA
AGROX CD	diazinon/ captan	26957	s	15/ 15	3	beans, peas, sweet corn	NRA
ALIAS 240 SC	imidacloprid	28475	i	240 g/L	4	brassica crops (see label), cucurbits (vine crops), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes	UAG/ MAN
ALIETTE WDG	fosetyl-AL	24458	f	80	3	brassica crops (see label), lettuce, onions, rutabagas, spinach	BCZ
ALLEGIANCE FL	metalaxyl	26674	s	317 g/L	3	beans, peas, sugarbeets, sweet corn	BCZ
ALLEGRO 500F	fluazinam	27517	f	500 g/L	3	beans, brassica crops (see label), carrots, potatoes	ISK
AMBUSH 500EC	permethrin	14882	i	500 g/L	4	asparagus, beans (snap), beets (table), broccoli, Chinese cabbage, Brussels sprouts, cabbage, cauliflower, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radishes, sugarbeets, sweet corn, tomatoes, turnips	AMV/ ENG

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Table 4–1. Pesticides Used on Vegetable Crops in Ontario

USE CODES:
a = acaricide
b = bactericide
cp = crop protectant
f = fungicide
h = herbicide
i = insecticide
m = miticide
n = nematicide
pgr = plant growth regulator
r = rodenticide
s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
ametoctradin/ dimethomorph	*See ZAMPRO*						
APRON MAXX RFC	metalaxyl-M and S/ fludioxonil	28817	s	3.46/ 2.31	3	beans, peas	SYZ
APRON XL LS	metalaxyl-M and S	25585	s	33.3	3	beans, beets (table), brassica crops (see label), carrots, cucurbits (vine crops), eggplant, parsley, lettuce (head and leaf), endive, onions (dry and bunching), parsnips, peas, peppers, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips	SYZ
ASSAIL 70 WP	acetamiprid	27128	i	70	4	brassica crops (see label), celery, parsley, lettuce (head and leaf), endive, peas, peppers, potatoes, rhubarb, rutabagas, spinach, Swiss chard, sweet corn, tomatoes	ENG
azoxystrobin	*See DYNASTY, QUADRIS FLOWABLE*						
azoxystrobin/ difenoconazole	*See QUADRIS TOP*						
azoxystrobin/ difenoconazole/ fludioxonil	*See STADIUM*						
azoxystrobin/ propiconazole	*See QUILT*						
Bacillus subtilis	*See CEASE, SERENADE*						
Bacillus thuringiensis	*See BIOPROTEC, DIPEL, THURICIDE*						
BASAMID GRANULAR	dazomet	15032	h, f, n	97	3	pre-plant preparation for eggplant, lettuce, peppers, tomatoes	ENG
Beauveria bassiana	*See BOTANIGARD*						
BELEAF 50SG	flonicamid	29796	i	50	4	beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rhubarb, rutabagas, Swiss chard, sweet potatoes, tomatoes, turnips	ISK/ UAG
bifenzate	*See ACRAMITE*						
BIOPROTEC 3P	*Bacillus thuringiensis* subsp. *kurstaki*	27750	i	21.7	4	peppers (transplants), sweet corn, tomatoes (transplants)	AFG

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m = miticide n = nematicide pgr = plant growth regulator r = rodenticide s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
BIOPROTEC CAF	*Bacillus thuringiensis* subsp. *kurstaki*	26854	i	8.12	3	beans (snap), brassica crops (see label), celery, garlic, herbs (see label), parsley, chives, lettuce, onions (dry and green), leeks, shallots, peppers, potatoes, spinach, sweet corn, tomatoes	AFG
BIO-SAVE 10 LP	*Pseudomonas syringae* Strain ESC-10	29673	f	29.8	4	sweet potatoes	see label
boscalid	*See CANTUS, LANCE*						
boscalid/pyraclostrobin	*See PRISTINE*						
BOTANIGARD 22WP	*Beauveria bassiana*	29321	i	4.4×10^{13} conidia/kg	3	eggplant, peppers, tomatoes	BWI
BOTANIGARD ES	*Beauveria bassiana*	29320	i	2.2×10^{13} conidia/kg	3	herbs (greenhouse transplants)	BWI
BOTRAN 75W	dicloran	8772	f	75	4	beans (snap), garlic, lettuce	GOW
BRAVO 500	chlorothalonil	15723	f	500 g/L	4	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), onions (dry bulb and green), parsnips, potatoes, sweet corn, tomatoes	SYZ
BUMPER 418 EC	propiconazole	28017	f	418 g/L	3	sweet corn	UAG/ MAN
BUSAN 1020	metam sodium	19421	h, f, n	33	4	pre-plant preparation	BUL
BUSAN 1180	metam potassium	25124	h, f, n	54	3	pre-plant preparation	BUL
BUSAN 1236	metam sodium	25103	h, f, n	42	4	pre-plant preparation	BUL
CABRIO EG	pyraclostrobin	27323	f	20	4	beets (table), carrots, cucurbits (vine crops), eggplant, garlic, horseradish, onions, leeks, shallots, peppers, radishes, rutabagas, tomatoes, turnips	BAZ
CABRIO PLUS	pyraclostrobin/ metiram	30395	f	5/ 55	3	potatoes	BAZ
CANTUS WDG	boscalid	30141	f	70	2	carrots, cucurbits (vine crops), eggplant, lettuce (head and leaf), onions (dry and green), leeks, shallots, peppers, potatoes, tomatoes	ENG
captan	*See MAESTRO, SUPRA CAPTAN*						
CARAMBA	metconazole	29767	f	90 g/L	3	sugarbeets	BAZ

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carbaryl	*See SEVIN XLR*						
carbathiin/thiram	*See PRO-GRO, VITAFLO*						
CEASE BIOLOGICAL	*Bacillus subtilis* strain QST713	30522	f	1 x 10^9 CFU/g	3	herbs (greenhouse transplants)	BWI
chlorantraniliprole	*See CORAGEN*						
chloropicrin	*See CHLOROPICRIN 100, PIC PLUS*						
CHLOROPICRIN 100	chloropicrin	25863	f, n	99	2	root and tuber vegetables — CG1 (beets (table), carrots, horseradish, parsnip, radishes, rutabagas, sugarbeets, sweet potatoes, turnips), peppers, potatoes, tomatoes	TEA/ DAS
chlorothalonil	*See BRAVO, ECHO*						
chlorpyrifos	*See LORSBAN, NUFOS, PYRIFOS, PYRINEX, WARHAWK*						
CITATION 75WP	cyromazine	24465	i	75	3	brassica leafy greens (see label), celery, parsley, lettuce (head and leaf), endive, spinach, Swiss chard	SYZ
citric/lactic acid	*See TIVANO*						
clothianidin	*See CLUTCH, PONCHO, TITAN*						
CLOSER	sulfoxaflor	30826	i	240 g/L	3	beets (table), brassica crops (see label), carrots, celery, parsley, horseradish, lettuce (head and leaf), endive, parsnips, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sweet potatoes, turnips	DWE
CLUTCH 50 WDG	clothianidin	29382	i	50	2	potatoes, sweet potatoes	VCI
CONCEPT	imidacloprid/ deltamethrin	29611	i	75 g/L/ 10 g/L	3	brassica crops (see label), tomatoes	BCZ
CONFINE EXTRA	mono- and di-potassium salts of phosphorous acid	30648	f	53	4	brassica crops (see label), eggplant, basil, lettuce, endive, radicchio, peppers, potatoes, tomatoes	ACC
Coniothyrium minitans	*See CONTANS*						
CONTANS WG	*Coniothyrium minitans*	29066	f	5.3	4	beans (snap), cabbage, carrots, celery, lettuce, tomatoes	UAG
COPPER 53W	copper sulphate	9934	f	53.4	3	beans, beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), eggplant, peppers, potatoes, spinach, tomatoes	LLP

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Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
copper hydroxide	*See COPPERCIDE, KOCIDE, PARASOL*						
copper oxychloride	*See COPPER SPRAY*						
COPPER SPRAY	copper oxychloride	19146	f	50	4	celery, cucurbits (vine crops), onions, potatoes, tomatoes	LLP
copper sulphate	*See COPPER 53W*						
COPPERCIDE WP	copper hydroxide	16047	f	50	3	beans, cucumbers, peppers (field and transplants), potatoes, sugarbeets, tomatoes (field and transplants)	LLP
CORAGEN	chlorantraniliprole	28982	i	200 g/L	2	beans, beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sugarbeets, sweet corn, sweet potatoes, tomatoes, turnips	DUQ
CRUISER 5FS	thiamethoxam	27045	s	47.6	3	beans, peas, sugarbeets, sweet corn	SYZ
CURZATE 60 DF	cymoxanil	26284	f	60	3	potatoes	DUQ
cyantraniliprole	*See EXIREL, VERIMARK*						
cyazofamid	*See RANMAN, TORRENT*						
CYGON 480	dimethoate	8277	i	480 g/L	3	asparagus, beans, beets (table), bok choy, broccoli, Brussels sprouts, cauliflower, Chinese broccoli, kale, eggplant, lettuce (leaf), peas, peppers, potatoes, Swiss chard, tomatoes	CAU/ BAT
cymoxanil	*See CURZATE*						
cypermethrin	*See RIPCORD, UP-CYDE*						
cyprodinil/fludioxonil	*See SWITCH*						
cyromazine	*See CITATION, GOVERNOR*						
DADS	diallyl disulfide	29333	f	90	3	garlic, chives, onions, leeks, shallots	LLP
dazomet	*See BASAMID*						
DCT	diazinon/ captan/ thiophanate-methyl	14986	s	6/ 18/ 14	4	sweet corn	NRA

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DECIS 5 EC	deltamethrin	22478	i	50 g/L	3	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, kale, onions, peppers, potatoes, sweet corn, tomatoes	BCZ
DECREE 50 WDG	fenhexamid	26132	f	50	3	tomatoes (transplants)	ALS
DELEGATE WG	spinetoram	28778	i	25	3	asparagus, brassica crops (see label), celery, garlic, parsley, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnips	DWE
deltamethrin	*See DECIS*						
diallyl disulfide	*See DADS*						
diazinon	*See DIAZINON*						
DIAZINON 50WSP	diazinon	29976	i	50	3	carrots, onions, parsnips	LLP
DIAZINON 500 E	diazinon	11889	i	500 g/L	3	onions (bulb and green), parsnips	LLP
diazinon/captan	*See AGROX*						
diazinon/captan/ thiophanate-methyl	*See DCT*						
DIBROM	naled	7442	i	900 g/L	3	beans (lima), broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, onions (bulb), peas, potatoes, sugarbeets, tomatoes	LLP
dicloran	*See BOTRAN*						
difenoconazole	*See INSPIRE*						
difenoconazole/ metalaxyl-M and S	*See DIVIDEND*						
dimethoate	*See CYGON, LAGON*						
dimethomorph	*See ACROBAT*						
DIPEL 2X DF	*Bacillus thuringiensis* subsp. *kurstaki*	26508	i	57	4	broccoli, cabbage, cauliflower, Chinese cabbage, bok choy, Chinese broccoli, mustard greens, kale, herbs (see label), parsley, lettuce, Asian radish, spinach, sweet corn, tomatoes	VBC
DITHANE RAINSHIELD	mancozeb	20553	f	75	4	carrots, celery, cucurbits (vine crops), onions (dry bulb), potatoes, tomatoes	DWE
DITHANE F-45	mancozeb	20552	f	37	4	seed potatoes (post-harvest)	DWE

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DIVIDEND XL RTA	difenoconazole/ metalaxyl-M and S	25777	s	3.37/ 0.27	3	sweet corn	SYZ
DYNASTY 100FS	azoxystrobin	28394	s	100 g/L	3	brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, parsley, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, parsnips, peppers, radishes, rutabagas, spinach, Swiss chard, sugarbeets, sweet corn, tomatoes, turnips	SYZ
ECHO 720	chlorothalonil	29355	f	720 g/L	4	onions (dry bulb and green), parsnips	UAG
ECHO 90DF	chlorothalonil	29356	f	90	4	broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), potatoes, sweet corn, tomatoes	UAG
EMESTO SILVER	penflufen/ prothioconazole	30361	f	100 g/L/ 18 g/L	4	potatoes	BCZ
endosulfan	*See THIONEX*						
ENFUSE M 510	sodium methyldithiocarbamate	29142	h, f, n	41.98	4	pre-plant preparation	ENG/ TAM
ENTRUST	spinosad	30382	i	240 g/L	4	asparagus, beans, brassica crops (see label), celery, eggplant, parsley, horseradish, lettuce (head and leaf), endive, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sweet corn, tomatoes, turnips	DWE
ENTRUST 80	spinosad	27825	i	80	3	brassica crops (see label), garlic, chives, onions (dry bulb and green), leeks, shallots	DWE
EXIREL	cyantraniliprole	30895	i	100 g/L	3	brassica crops (see label), celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, potatoes, rhubarb, spinach, Swiss chard, sweet potatoes, tomatoes	DUQ
FALGRO TABLET	gibberellic acid	27653	pgr	1 g/tablet	4	potatoes	NRA
famoxadone/cymoxanil	*See TANOS*						
fenamidone	*See REASON*						
fenhexamid	*See DECREE*						

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ferbam	*See FERBAM*						
FERBAM 76 WDG	ferbam	20136	f	76	4	lettuce (transplants)	LLP
ferric phosphate	*See SLUGGO*						
FLINT	trifloxystrobin	30619	f	50	4	asparagus, carrots, celery, horseradish, parsnips, radishes, rutabagas, sugarbeets, turnips	BCZ
flonicamid	*See BELEAF*						
fluazinam	*See ALLEGRO*						
fludioxonil	*See MAXIM 480, MAXIM LIQUID, MAXIM PSP, SCHOLAR*						
fludioxonil/ difenoconazole	*See MAXIM D*						
fludioxonil/ mancozeb	*See MAXIM MZ*						
fludioxonil/ metalaxyl-M and S	*See MAXIM XL*						
fluopicolide	*See PRESIDIO*						
fluopyram/pyrimethanil	*See LUNA*						
FOLPAN 80 WDG	folpet	27733	f	80	4	cucurbits (vine crops), tomatoes	UAG/ MAN
folpet	*See FOLPAN*						
FONTELIS	penthiopyrad	30331	f	200 g/L	4	beans, brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, parsnips, peas, peppers, radishes, rutabagas, spinach, Swiss chard, tomatoes, turnips	DUQ
FORCE 3.0G	tefluthrin	23917	i	3	3	sweet corn	SYZ
fosetyl-AL	*See ALIETTE*						
FULFILL 50WG	pymetrozine	27274	i	50	3	celery, parsley, lettuce (head and leaf), endive, potatoes, rhubarb, spinach, Swiss chard	SYZ
GAUCHO 480 FL	imidacloprid	26124	s	480 g/L	4	beans, sweet corn	BCZ
GAVEL 75DF	zoxamide/ mancozeb	26842	f	8.3/ 66.7	4	potatoes	GOW
gibberillic acid	*See FALGRO*						

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Gliocladium catenulatum	*See PRESTOP*						
GOVERNOR 75WP	cyromazine	24464	s	75	2	imported onion seed (dry bulb and green)	SYZ
GRANUFLO-T	thiram	30548	f	75	3	sweet potatoes	ENG
GRAPPLE$_2$	imidacloprid	29048	i	240 g/L	3	cucurbits (vine crops), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes	CAU
HEADLINE EC	pyraclostrobin	27322	f	250 g/L	3	beans, peas, potatoes, sugarbeets, sweet corn	BAZ
hydrogen peroxide	*See STOROX*						
imidacloprid	*See ADMIRE, ALIAS, GAUCHO, GRAPPLE$_2$*						
imidacloprid/ deltamethrin	*See CONCEPT*						
IMIDAN 70-WP	phosmet	29064	i	70	3	carrots, celery, potatoes	GOW
INSPIRE	difenoconazole	30004	f	250 g/L	3	brassica crops (see label), cucurbits (vine crops), eggplant, garlic, onions (dry bulb and green), leeks, shallots, peppers, potatoes, sugarbeets, tomatoes	SYZ
INTREPID	methoxyfenozide	27786	i	240 g/L	3	beans, brassica crops (see label), celery, parsley, lettuce (head and leaf), endive, peppers, rhubarb, spinach, Swiss chard, sweet corn, tomatoes	DWE
iprodione	*See ROVRAL*						
KANEMITE 15 SC	acequinocyl	28641	m	15.8	3	eggplant	ALS
kaolin	*See SURROUND*						
kasugamycin	*See KASUMIN*						
KASUMIN 2L	kasugamycin	30591	b	2	3	peppers, tomatoes	ALS
KOCIDE 2000	copper hydroxide	27348	f, s	53.8	3	beans, peppers (field and transplants), potatoes, tomatoes (field and transplants)	DUQ
LAGON 480 E	dimethoate	9382	i	480 g/L	3	asparagus, beans (snap), beets (table), bok choy, broccoli, Brussels sprouts, cauliflower, Chinese broccoli, celery, eggplant, lettuce (leaf), peas, peppers, potatoes, Swiss chard, tomatoes	LLP
lambda-cyhalothrin	*See MATADOR, SILENCER*						

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Examples of Brand Name/ Trade Name[1]	**Active Ingredient/ Common Name**	**Registration Number/ PCP #**[2]	**Use**	**Guaranteed % Active Unless Stated**	**Ontario Class**[3]	**Crop Registrations**	**Company or Agent's Code**[4]
lambda-cyhalothrin/ chlorantraniliprole	*See VOLIAM*						
LANCE WDG	boscalid	27495	f	70	2	beans, peas	BAZ
LANNATE TOSS-N-GO (TNG)	methomyl	10868	i	90	2	beans, broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, peas, sweet corn, tomatoes	DUQ
LORSBAN 15G	chlorpyrifos	16458	i	15	4	broccoli, Brussels sprouts, cabbage, cauliflower, onions (bulb and pickling), shallots, rutabagas	DWE
LORSBAN 4E	chlorpyrifos	14879	i	480 g/L	3	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber, garlic, onions (bulb and pickling), onions (green), pepper (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	DWE
LORSBAN 50W	chlorpyrifos	20944	i	50	3	cabbage	DWE
LORSBAN NT	chlorpyrifos	29650	i	452 g/L	3	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber, garlic, onions (bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	DWE
LUNA TRANQUILITY	fluopyram/ pyrimethanil	30510	f	125 g/L/ 375 g/L	2	potatoes	BCZ
MAESTRO 80DF	captan	26408	f	80	3	cucumber, tomatoes, vegetable transplants in greenhouse (crucifers, celery, eggplant, peppers, tomatoes)	ALS
malathion	*See MALATHION*						
MALATHION 25W	malathion	14656	i	25	4	asparagus, beets (table), cucurbits (vine crops), eggplant, peas, peppers, spinach, tomatoes	LLP
MALATHION 85E	malathion	8372	i	85	3	beans, broccoli, Brussels sprouts, cabbage, cauliflower, kale, kohlrabi, carrots, celery, cucumbers, squash, pumpkins, melons, eggplant, garlic, parsley, lettuce (head and leaf), parsnips, peas, peppers, radishes, rutabagas, spinach, Swiss chard, sugarbeets, tomatoes,turnips	LLP

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mancozeb	*See DITHANE, MANZATE PRO-STICK, PENNCOZEB, PSPT, SOLAN, TUBERSEAL*						
mandipropamid	*See REVUS*						
MANZATE PRO-STICK	mancozeb	28217	f	75	3	carrots, celery, cucumbers, pumpkins, melons, squash, cantaloupe, onions (dry bulb), potatoes, sugarbeets, tomatoes	UPI
MATADOR 120EC	lambda-cyhalothrin	24984	i	120 g/L	2	asparagus, beans, brassica crops (see label), carrots, celery, cucurbits (vine crops), garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes	SYZ
MAXIM 480FS	fludioxonil	27001	s	40	3	beets (table), brassica crops (see label), cucurbits (vine crops), eggplant, herbs, peppers, sugarbeets, sweet corn, tomatoes	SYZ
MAXIM D	fludioxonil/ difenoconazole	30599	s	19.4 g/L/ 19.4 g/L	3	potato seed piece	SYZ
MAXIM LIQUID PSP	fludioxonil	29110	s	40.3	3	potato seed piece	SYZ
MAXIM MZ PSP	fludioxonil/ mancozeb	27965	s	0.5/ 5.7	3	potato seed piece	SYZ
MAXIM PSP	fludioxonil	26647	s	0.5	3	potato seed piece	SYZ
MAXIM XL	fludioxonil/ metalaxyl-M and S	27071	s	21/ 8.4	3	sweet corn	SYZ
metalaxyl	*See ALLEGIANCE*						
metalaxyl-M and S	*See APRON XL LS, RIDOMIL GOLD 1G, RIDOMIL GOLD 480SL*						
metalaxyl-M and S/ chlorothalonil	*See RIDOMIL GOLD SL/BRAVO*						
metalaxyl-M and S/ fludioxonil	*See APRON MAXX*						
metalaxyl-M and S/ mancozeb	*See RIDOMIL GOLD MZ*						
metam potassium	*See BUSAN 1180*						
metam sodium	*See BUSAN 1020, BUSAN 1236, VAPAM*						
metconazole	*See CARAMBA, QUASH*						
methomyl	*See LANNATE*						
methoxyfenozide	*See INTREPID*						
metiram	*See POLYRAM*						

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METTLE 125 ME	tetraconazole	30673	f	125 g/L	2	sugarbeets	IGU
MICROSCOPIC SULPHUR	sulphur	14653	f	92	4	rutabagas	LLP
MICROTHIOL DISPERSS	sulfur	29487	f	80	4	peas, sugarbeets	UAG
MILSTOP	potassium bicarbonate	28095	f	85	4	cucurbits (vine crops), herbs, peppers	BWI
mineral oil	*See SUPERIOR 70 OIL*						
MISSION 418 EC	propiconazole	28016	f	418 g/L	3	asparagus, rutabagas	UAG/ MAN
mono- and di-potassium salts of phosphorous acid	*See CONFINE, RAMPART*						
mono- and dibasic sodium, potassium and ammonium phosphites	*See PHOSTROL*						
MOVENTO 240 SC	spirotetramat	28953	i	240 g/L	4	brassica crops (see label), celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, potatoes, rhubarb, spinach, Swiss chard, sweet corn, sweet potatoes, tomatoes	BCZ
myclobutanil	*See NOVA*						
naled	*See DIBROM*						
NOVA	myclobutanil	22399	f	40	3	asparagus, cucurbits (vine crops)	DWE
novaluron	*See RIMON*						
NUFOS 4E	chlorpyrifos	25831	i	480 g/L	3	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sweet corn	CAU
OBERON FLOWABLE	spiromesifen	28905	i, m	240 g/L	3	cucurbits (vine crops), eggplant, peppers, sweet potatoes, tomatoes	BCZ
OPAL INSECTICIDAL SOAP	potassium salts of fatty acids	28146	i	47	4	herbs	OMD

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Examples of Brand Name/ Trade Name[1]	**Active Ingredient/ Common Name**	**Registration Number/ PCP #[2]**	**Use**	**Guaranteed % Active Unless Stated**	**Ontario Class[3]**	**Crop Registrations**	**Company or Agent's Code[4]**
ORTHENE 75% SOLUBLE POWDER (SP)	acephate	14225	i	75	3	Brussels sprouts, cabbage, cauliflower, celery, lettuce (head), peppers (sweet bell), potatoes, sweet corn, tomatoes	ALS
oxamyl	*See VYDATE*						
PARASOL FLOWABLE	copper hydroxide	25901	f	24.4	4	potatoes	NUA
PARASOL WG	copper hydroxide	29063	f	50	3	beans, cucumbers, peppers, sugarbeets, tomatoes	NUA
penflufen/ prothioconazole	*See EMESTO*						
PENNCOZEB 75DF RAINCOAT	mancozeb	30241	f	75	3	carrots, celery, cucurbits (vine crops), onions (dry bulb), potatoes, tomatoes	UPI
penthiopyrad	*See FONTELIS, VERTISAN*						
permethrin	*See AMBUSH, PERM-UP, POUNCE*						
PERM-UP	permethrin	28877	i	384 g/L	3	asparagus, beans (snap), beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips	UPI
phorate	*See THIMET*						
phosmet	*See IMIDAN*						
PHOSTROL	mono- and dibasic sodium, potassium and ammonium phosphites	30449	f	53.6	4	brassica crops (see label), cucurbits (vine crops), lettuce (head and leaf), endive, radicchio, potatoes, tomatoes	ENG
PIC PLUS	chloropicrin	28715	f, n	85.1	2	root and tuber vegetables — CG1 (beets (table), carrots, horseradish, parsnips, radishes, rutabagas, sugarbeets, sweet potatoes, turnips), peppers, potatoes, tomatoes	TEA/ DAS
picoxystrobin	*See ACAPELA*						
POLYRAM DF	metiram	20087	f	80	4	asparagus, carrots, celery, potatoes, sugarbeets, tomatoes	BAZ
PONCHO 600 FS	clothianidin	27453	s	600 g/L	2	sweet corn	BCZ
potassium bicarbonate	*See MILSTOP*						

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potassium salts of fatty acids	*See OPAL INSECTICIDAL SOAP*						
potassium salts of fatty acids/pyrethrins	*See SAFER'S TROUNCE*						
POUNCE 384EC	permethrin	16688	i	384 g/L	4	asparagus, beans (snap), beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips	UAG/ FMC
PRESIDIO	fluopicolide	30051	f	39.5	2	brassica crops (see label), cucurbits (vine crops), lettuce (head and leaf), potatoes, rutabagas, spinach, tomatoes	VCI
PRESTOP	*Gliocladium catenulatum*	28820	f	2 x 10^8 CFU/g	3	greenhouse herb transplants (oregano, basil, parsley, thyme, dill)	MHI
PRISTINE WG	boscalid/ pyraclostrobin	27985	f	25.2/ 12.8	2	brassica crops (see label), carrots, celery, cucurbits (vine crops), garlic, chives, onions (dry bulb and green), leeks, shallots, spinach	ENG
PRO-GRO	carbathiin/ thiram	10959	s	30/ 50	4	onions	CRE
PROLINE 480 SC	prothioconazole	28359	f	480 g/L	3	cucurbits (vine crops), sugarbeets	BCZ
propamocarb/ chlorothalonil	*See TATTOO C*						
propiconazole	*See BUMPER, MISSION, TILT, TOPAS*						
prothioconazole	*See PROLINE*						
PSPT 16%	mancozeb	24734.01	s	16	4	potatoes	LLP
Pseudomonas syringae	*See BIO-SAVE*						
pymetrozine	*See FULFILL*						
pyraclostrobin	*See CABRIO EG, HEADLINE*						
pyraclostrobin/metiram	*See CABRIO PLUS*						
PYRIFOS 15G	chlorpyrifos	24648	i	15	4	broccoli, Brussels sprouts, cabbage, cauliflower, onions (dry bulb and pickling), rutabagas, sweet corn	LLP
pyrimethanil	*See SCALA*						

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PYRINEX 480 EC	chlorpyrifos	23705	i	480 g/L	3	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, carrots, celery, cucumbers, garlic, onions (dry bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	UAG/ MAN
QUADRIS FLOWABLE	azoxystrobin	26153	f	250 g/L	3	asparagus, beets (table), cabbage, carrots, celery, horseradish, potatoes, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips	SYZ
QUADRIS TOP	azoxystrobin/ difenoconazole	30518	f	200 g/L/ 125 g/L	3	brassica crops (see label), carrots, cucurbits (vine crops), eggplant, garlic, chives, onions (dry bulb and green), leeks, shallots, peppers, potatoes, sugarbeets, tomatoes	SYZ
QUASH FUNGICIDE	metconazole	30402	f	50	3	potatoes	VCI
QUILT	azoxystrobin/ propiconazole	28328	f	75 g/L/ 125 g/L	3	mint, peas, sweet corn	SYZ
quinoxyfen	*See QUINTEC*						
QUINTEC	quinoxyfen	29755	f	250 g/L	3	melons, pumpkins, winter squash, lettuce (head and leaf)	DWE
RAMPART	mono- and dipotassium salts of phosphorous acid	30654	f	53	4	potatoes	LLP
RANMAN 400SC	cyazofamid	30716	f	34.5	4	beans, brassica crops (see label), carrots, cucurbits (vine crops), basil, lettuce (head and leaf), potatoes, spinach, tomatoes, transplants (brassica crops, cucumber, lettuce, peppers, tomatoes)	ISK
REASON 500SC	fenamidone	27462	f	500 g/L	3	brassica crops (see label), carrots, onions (dry bulb and green), leeks, shallots, potatoes, spinach, tomatoes	BCZ
REGALIA MAXX	extract of *Reynoutria sachalinensis*	30199	f	20	3	cucurbits (vine crops), tomatoes	MBI
REVUS	mandipropamid	29074	f	23.3	3	brassica crops (see label), garlic, lettuce (head and leaf), onions (dry bulb), shallots, pepper (transplants), potatoes, spinach, tomatoes	SYZ

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Reynoutria sachalinensis, extract of	*See REGALIA*						
RIDOMIL GOLD 1G	metalaxyl-M and S-isomer	26612	f	1	3	carrots, lettuce (head)	SYZ
RIDOMIL GOLD 480SL	metalaxyl-M and S-isomer	28474	f	480 g/L	3	beans (snap), cucumbers, potatoes, radish, spinach	SYZ
RIDOMIL GOLD MZ 68WG	metalaxyl-M and S-isomer/mancozeb	28893	f	4/ 64	3	lettuce (head), onions, potatoes	SYZ
RIDOMIL GOLD/ BRAVO twin pak	metalaxyl-M and S/ chlorothalonil	Check label.	f	480 g/L/ 500 g/L	3	potatoes	SYZ
RIMON 10 EC	novaluron	28881	i	10	2	beans (snap), brassica crops (see label), peppers, potatoes	CRE
RIPCORD 400 EC	cypermethrin	15738	i	407 g/L	3	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips	BAZ
ROOTSHIELD GRANULES	*Trichoderma harzianum*	27116	f	1.0 x 10^7 CFU/g	4	cucumbers, peppers, tomatoes	BWI
ROOTSHIELD HC	*Trichoderma harzianum*	27115	f, s	1.0 x 10^7 CFU/g	4	beans, lettuce, peas, peppers, tomatoes	BWI
ROVRAL	iprodione	15213	f, s	500 g/kg	3	beans (snap), cabbage, cauliflower, carrots (imported seed), garlic, lettuce, onions (dry bulb), leeks	FMC
SAFER'S TROUNCE	potassium salts of fatty acids/ pyrethrins	24363	i	20/ 0.2	4	herbs	WCC
SCALA SC	pyrimethanil	28011	f	400 g/L	3	garlic, chives, onions (bulb and green), leeks, shallots, potatoes, tomatoes	BCZ
SCHOLAR 230SC	fludioxonil	29528	f	230 g/L	4	carrots, sweet potatoes	SYZ
SENATOR 70WP	thiophanate-methyl	25343	f	70	4	sugarbeets	NSC
SENATOR PSPT	thiophanate-methyl	26236	s	10	4	potato seed piece	NSC
SERENADE ASO	*Bacillus subtilis*	28626	f	1 x 10^9 CFU/g	4	brassica crops (see label), carrots, cucurbit crops (vine crops), eggplant, lettuce, endive, peppers, potatoes, spinach, tomatoes	BCZ
SERENADE MAX	*Bacillus subtilis*	28549	f	7.3 x 10^9 CFU/g	4	celery, garlic, parsley, chives, lettuce, endive, onions (all types), leeks, shallots, sweet potatoes	BCZ

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Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
SEVIN XLR	carbaryl	27876	i	466 g/L	3	asparagus, beans, broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, kohlrabi, mustard greens, carrots, celery, cucurbits (vine crops), eggplant, parsley, horseradish, lettuce (head and leaf), endive, peppers, radish, rutabagas, sweet corn, tomatoes, turnips	TKI
SILENCER 120 EC	lambda-cyhalothrin	29052	i	120 g/L	2	asparagus, beans, brassica crops (see label), carrots, garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes	UAG/ MAN
SLUGGO PROFESSIONAL	ferric phosphate	30025	i	0.76	4	beans, brassica crops, peas, rhubarb, sweet corn, sweet potatoes	ENG
sodium methyldithiocarbamate	*See ENFUSE*						
SOLAN MZ POTATO ST FUNGICIDE	mancozeb	29377	s	16	4	potato seed piece	NRA
spinetoram	*See DELEGATE*						
spinosad	*See ENTRUST, SUCCESS*						
spiromesifen	*See OBERON*						
spirotetramat	*See MOVENTO*						
STADIUM	azoxystrobin/ difenoconazole/ fludioxonil	31050	f	143 g/L/ 112 g/L/ 143 g/L	4	potatoes, sweet potatoes	SYZ
STOROX	hydrogen peroxide	27432	f	27	2	potatoes, sweet potatoes	BIB
Streptomyces lydicus	*See ACTINOVATE*						
SUCCESS	spinosad	26835	i	480 g/L	4	asparagus, beans (snap), brassica crops (see label), celery, eggplant, garlic, parsley, chives, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sweet corn, tomatoes, turnips	DWE
sulfoxaflor	*See CLOSER*						
sulphur/sulfur	*See MICROSCOPIC SULPHUR, MICROTHIOL DISPERSS*						

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[2] See the pesticide label to confirm the current product registration number (PCP#).

[3] The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOE the classification of pesticide products before they can be sold or used in Ontario. Most pesticides used in vegetable crops are either a Class 2, 3 or 4. Users of Class 2 and 3 products must be certified through the Grower Pesticide Safety Course.
Class 2: Restricted or commercial use only; very hazardous and/or persistent
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Class 4: Restricted or commercial use only; less or least hazardous and/or low persistence

[4] See *Table 4-2. Pest Control Product Companies,* on page 253.

Table 4–1. Pesticides Used on Vegetable Crops in Ontario

USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide
m = miticide n = nematicide pgr = plant growth regulator r = rodenticide s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
SUPERIOR 70 OIL	mineral oil	14981	a, i	99	4	potatoes, rutabagas	LLP
SUPRA CAPTAN 80 WDG	captan	24613	f	80	3	cucumbers, tomatoes, vegetable transplants in greenhouse (eggplant, peppers, tomatoes)	LLP
SURROUND WP	kaolin	27469	cp	95	4	carrots, celery, cucurbits (vine crops), parsley, lettuce, potatoes	BAT
SWITCH 62.5 WG	cyprodinil/ fludioxonil	28189	f	37.5/ 25	3	beans, beets (table), cabbage, mustard greens, carrots, horseradish, onions (dry bulb and green), parsnips, peppers, radishes, rutabagas, spinach, tomatoes, turnips	SYZ
TANOS 50 DF	famoxadone/ cymoxanil	27435	f	25/ 25	3	potatoes, tomatoes	DUQ
TATTOO C	propamocarb/ chlorothalonil	24544	f	375 g/L/ 375 g/L	3	cucurbits (vine crops), potatoes	BCZ
tefluthrin	*See FORCE*						
tetraconazole	*See METTLE*						
thiamethoxam	*See ACTARA, CRUISER*						
THIMET 15-G	phorate	10532	i	15	3	potatoes	AMV/ ENG
THIONEX 50W WSP	endosulfan	29990	i	50	2	celery, cucumber, melon, squash, pumpkin, eggplant, lettuce (head), peppers, potatoes	LLP
THIONEX EC	endosulfan	23453	i	400 g/L	3	eggplant, peppers, sugarbeets, tomatoes	UAG
thiophanate-methyl	*See SENATOR*						
thiram	*See GRANUFLO-T, THIRAM*						
THIRAM 75 WP	thiram	27556	s	75	3	beans (snap), beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, mustard, carrots, celery, cucurbits (vine crops), eggplant, lettuce, onions, peas, peppers, radishes, spinach, sugarbeets, sweet corn, sweet potatoes, tomatoes, turnips	CRE
THURICIDE HPC	*Bacillus thuringiensis* subsp. *kurstaki*	11302	i	15	4	broccoli, Brussels sprouts, cabbage, cauliflower, kale, mustard greens, celery, lettuce, spinach, tomatoes	CUL
TILT 250E	propiconazole	19346	f	250 g/L	3	sweet corn	SYZ
TITAN (TITAN ST)	clothianidin	27449	s	600 g/L	2	potatoes	BCZ

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide
m = miticide n = nematicide pgr = plant growth regulator r = rodenticide s = seed treatment

Examples of Brand Name/ Trade Name[1]	Active Ingredient/ Common Name	Registration Number/ PCP #[2]	Use	Guaranteed % Active Unless Stated	Ontario Class[3]	Crop Registrations	Company or Agent's Code[4]
TIVANO	citric/lactic acid	30468	f, b	10.73 g/L/ 21.37 g/L	4	pumpkins, squash, tomatoes	AFG
TOPAS	propiconazole	30163	f	250 g/L	3	asparagus, rutabagas	SYZ
TORRENT 400SC	cyazofamid	30392	f	34.5	4	beans, brassica crops (see label), carrots, cucurbits (vine crops), basil, lettuce (head and leaf), potatoes, spinach, tomatoes, greenhouse transplants (tomatoes, peppers, cucumber, brassicas and lettuce)	ENG/ ISK
Trichoderma harzianum	*See ROOTSHIELD*						
trifloxystrobin	*See FLINT*						
TUBERSEAL	mancozeb	17042	s	16	4	potato seed piece	NRA
UP-CYDE 2.5 EC	cypermethrin	28795	i	250 g/L	3	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips	UPI
VAPAM HL	metam sodium	29128	h, f, n	42	4	pre-plant preparation (see label)	UAG
VERIMARK	cyantraniliprole	30892	i	200 g/L	3	brassica crops (see label), potatoes	DUQ
VERTISAN	penthiopyrad	30332	f	200 g/L	4	potatoes, sugarbeets, sweet corn, sweet potatoes	DUQ
VITAFLO 280	carbathiin/ thiram	11423	s	15.59/ 13.25	4	beans (snap), peas	CRE
VOLIAM XPRESS	lambda-cyhalothrin/ chlorantraniliprole	30325	i	50 g/L/ 100 g/L	2	sweet corn	SYZ
VYDATE L	oxamyl	17995	i	240 g/L	2	potatoes	DUQ
WARHAWK 480 EC	chlorpyrifos	29984	i	480 g/L	3	broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumbers, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	LLP
ZAMPRO	ametoctradin/ dimethomorph	30321	f	300 g/L/ 225 g/L	3	brassica crops (see label), cucurbits (vine crops), eggplant, garlic, lettuce (head and leaf), endive, radicchio, onions (dry bulb and green), leeks, shallots, peppers, potatoes, tomatoes	BAZ
zoxamide/mancozeb	*See GAVEL*						

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[4] See *Table 4–2. Pest Control Product Companies*, on page 253.

Table 4–2. Pest Control Product Companies

Code[1]	Company/Agent	Website[2]	Contact Number
ACC	Agronomy Company of Canada	—	519-461-9057
AFG	AEF Global Inc.	www.aefglobal.com/en/	1-866-622-3222
ALS	Arysta LifeScience North America	www.arystalifescience.ca	1-866-761-9397
AMV	AMVAC Chemical Corp.	www.amvac-chemical.com	1-888-462-6822
BAT	Bartlett, N.M. Inc.	www.bartlett.ca	1-800-263-1287
BAZ	BASF Canada Inc.	www.agsolutions.ca	1-877-371-2273
BCZ	Bayer CropScience Inc.	www.cropscience.bayer.ca/	1-888-283-6847
BIB	BioSafe Systems	www.biosafesystems.com	1-860-290-8890
BUL	Buckman Laboratories of Canada Ltd.	www.buckman.com	1-450-424-4404
BWI	BioWorks Inc.	www.bioworksinc.com	1-800-877-9443
CAU	Cheminova Canada Inc.	www.cheminova.ca	1-888-316-6260
CRE	Chemtura Canada Co.	www.chemturaagrosolutions.com/	1-800-350-1745
CUL	Certis USA LLC.	www.certisusa.com	1-800-847-5620
DAS	Douglas Agricultural Services Inc.	—	519-427-8195
DUQ	E.I. du Pont Canada Co.	www.dupont.ca	1-800-667-3925
DWE	Dow Agrosciences Canada Inc.	www.dowagro.com/ca	1-800-667-3852
ENG	Engage Agro Corp.	www.engageagro.com	519-826-7878
FMC	FMC Corporation	www.fmccrop.ca	1-888-593-6224
GOW	Gowan Company	www.gowanco.com	1-800-883-1844
IGU	Isagro USA, Inc.	www.isagro-usa.com	919-321-5200
ISK	ISK BioSciences Corp.	www.iskbc.com	1-877-706-4640
MAN	MANA (Makhteshim Agan of North America) Canada Ltd.	www.manainc.ca	919-256-9305
MBI	Marrone Bio Innovations, Inc.	www.marronebioinnovations.com	1-877-664-4476
MHI	MGS Horticultural Inc.	www.mgshort.com	519-326-9037
NRA	Norac Concepts Inc.	www.noracconcepts.com	519-821-3633
NSC	Nippon Soda Co., Ltd.	www.nippon-soda.co.jp/e/ (Japan website)	212-490-0350
NUA	Nufarm Agriculture Inc.	www.nufarm.ca	1-800-868-5444
OMD	Omex Agriculture Inc.	www.omexcanada.com	1-866-860-9660
SYZ	Syngenta Crop Protection Canada Inc.	www.syngenta.com	1-877-964-3682
TAM	Taminco, Inc.	www.taminco.com	1-800-426-3820
TEA	TriEst Ag Group	—	252-758-4263
TKI	Tessenderlo Kerley, Inc.	www.tkinet.com	1-800-525-2803
UAG	United Agri Products Canada Inc./Loveland Products Canada Inc.	www.uap.ca	1-800-265-4624
UPI	United Phosphorus Inc.	www.uplonline.com	1-800-438-6071
VBC	Valent BioSciences Corporation	www.valent.ca	1-800-323-9597
VCI	Valent Canada Inc.	www.valent.ca	519-767-9262
WCC	Woodstream Canada Corporation	www.woodstream.com	1-800-800-1819

[1] The three-letter manufacturers' codes represent the codes listed in *Table 4–1. Pesticides Used on Vegetable Crops in Ontario*, on page 233.

[2] Where possible, Canadian websites are listed.

Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals,* on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Acapela	picoxystrobin	12 hr	sweet corn
Acramite 50WS	bifenazate	12 hr	eggplant, peppers, tomatoes
Acrobat 50 WP	dimethomorph	**hand-harvesting and irrigation:** 7 days **scouting:** 5 days **all other activities:** 12 hr	brassica crops (see label)
		thinning: 48 hr **all other activities:** 12 hr	garlic, onions (dry bulb), leeks, shallots
		hand-harvesting: 48 hr **all other activities:** 12 hr	onions (green)
		hand-harvesting: 48 hr **all other activities:** 12 hr	lettuce (head and leaf)
		12 hr	peppers, potatoes, tomatoes
Actara 240SC	thiamethoxam	12 hr	brassica crops (see label), celery, cucurbits (vine crops), eggplant, parsley, lettuce (head and leaf), endive, peppers, potatoes, spinach, tomatoes
Actara 25WG	thiamethoxam	12 hr	beets (table), carrots, celery, eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rutabagas, spinach, Swiss chard, sweet potatoes, tomatoes, turnips
Actigard 50 WG	acibenzolar-S-methyl	12 hr	tomatoes
Actinovate SP	*Streptomyces lydicus*	1 hr	peppers, tomatoes
Admire 240 F	imidacloprid	24 hr	beans, beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, herbs (see label), parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rutabagas, spinach, Swiss chard, sweet potatoes, tomatoes, turnips
Agri-mek 1.9% EC	abamectin	Re-entry permitted once spray deposit has dried.	celery, garlic, onions (dry bulb), shallots
Alias 240 SC	imidacloprid	24 hr	brassica crops (see label), cucurbits (vine crops), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes
Aliette WDG	fosetyl-AL	12 hr	brassica crops (see label), lettuce, onions, rutabagas, spinach
Allegro 500F	fluazinam	24 hr	beans, brassica crops (see label), carrots, potatoes
Ambush 500EC	permethrin	Re-entry permitted once spray deposit has dried.	asparagus, beans (snap), beets (table), broccoli, Chinese cabbage, Brussels sprouts, cabbage, cauliflower, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radishes, sugarbeets, sweet corn, tomatoes, turnips

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Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Assail 70 WP	acetamiprid	12 hr	celery, parsley, lettuce (head and leaf), endive, peas, peppers, potatoes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes
		scouting: 48 hr **other activities:** 4 days	brassica crops (see label)
		hand-harvesting: 10 days	sweet corn
Beleaf 50SG	flonicamid	12 hr	beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rhubarb, rutabagas, Swiss chard, sweet potatoes, tomatoes, turnips
Botanigard 22WP	*Beauveria bassiana*	4 hr	eggplant, peppers, tomatoes
Botanigard ES	*Beauveria bassiana*	4 hr	herbs (greenhouse transplants)
Botran 75W	dicloran	12 hr	beans (snap), garlic, lettuce
Bravo 500	chlorothalonil	48 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), onions (dry bulb and green), parsnips, potatoes, sweet corn, tomatoes
Bumper 418 EC	propiconazole	**hand-harvesting, detasselling:** 24 hr **all other activities:** 12 hr	sweet corn
Cabrio EG	pyraclostrobin	**hand-harvesting:** 3 days **all other activities:** 12 hr	beets (table), carrots, horseradish, radishes, rutabagas, turnips
		hand-harvesting, thinning, pruning: 3 days **all other activities:** 12 hr	cucurbits (vine crops)
		12 hr	eggplant, peppers, tomatoes
		thinning: 3 days **all other activities:** 12 hr	garlic, onions, leeks, shallots,
Cabrio Plus	pyraclostrobin/metiram	12 hr	potatoes
Cantus WDG	boscalid	12 hr	carrots, cucurbits (vine crops), eggplant, lettuce (head and leaf), onions (dry and green), leeks, shallots, peppers, potatoes, tomatoes
Caramba	metconazole	9 days	sugarbeets
Chloropicrin 100	chloropicrin	See label for re-entry information.	root and tuber vegetables — CG1 (beets (table), carrots, horseradish, parsnip, radishes, rutabagas, sugarbeets, sweet potatoes, turnips), peppers, potatoes, tomatoes
Citation 75WP	cyromazine	12 hr	brassica leafy greens (see label), celery, parsley, lettuce (head and leaf), endive, spinach, Swiss chard
Closer	sulfoxaflor	12 hr or until residues have dried	beets (table), brassica crops (see label), carrots, celery, parsley, horseradish, lettuce (head and leaf), endive, parsnips, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sweet potatoes, turnips
Clutch 50 WDG	clothianidin	12 hr	potatoes, sweet potatoes
Concept	imidacloprid/deltamethrin	12 hr	brassica crops (see label), tomatoes

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If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Copper 53W	copper sulphate	48 hr	beans, beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), eggplant, potatoes, peppers, spinach, tomatoes
Copper Spray	copper oxychloride	48 hr	celery, cucurbits (vine crops), onions, potatoes, tomatoes
Coppercide WP	copper hydroxide	24 hr	peppers (transplants), tomatoes (transplants)
Coragen	chlorantraniliprole	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, sugarbeets, sweet corn, sweet potatoes, tomatoes, turnips
Curzate 60 DF	cymoxanil	24 hr	potatoes
Decree 50 WDG	fenhexamid	4 hr	tomatoes (transplants)
Delegate WG	spinetoram	12 hr	asparagus, brassica crops (see label), celery, garlic, parsley, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, potatoes, radishes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnips
Diazinon 50WSP	diazinon	3 days	carrots, onions, parsnips
Diazinon 500 E	diazinon	3 days	onions (bulb and green), parsnips
Dibrom	naled	48 hr	beans (lima), broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, onions (bulb), peas, potatoes, sugarbeets, tomatoes
Echo 720	chlorothalonil	48 hr	onions (dry bulb and green), parsnips
Echo 90DF	chlorothalonil	48 hr	broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbits (vine crops), potatoes, sweet corn, tomatoes
Entrust	spinosad	Re-entry permitted once spray deposit has dried.	asparagus, beans, parsley, horseradish, celery, eggplant, lettuce (head and leaf), endive, peppers, radishes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnips
		hand-harvesting, irrigating, pruning, topping, thinning, tying: 3 days Re-entry permitted for all other activities once spray deposit has dried.	brassica crops (see label)
		12 hr	potatoes
		hand-harvesting: 7 days Re-entry permitted for all other activities once spray deposit has dried.	sweet corn

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Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Entrust 80	spinosad	**hand-harvesting, irrigating, pruning, topping, thinning, tying:** 3 days Re-entry permitted for all other activities once spray deposit has dried.	brassica crops (see label)
		Re-entry permitted once spray deposit has dried.	garlic, chives, onions (dry bulb and green), leeks, shallots
Exirel	cyantraniliprole	12 hr	brassica crops (see label), celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, potatoes, rhubarb, spinach, Swiss chard, sweet potatoes, tomatoes
Falgro	gibberellic acid	12 hr	potato seed
Flint	trifloxystrobin	12 hr	asparagus, carrots, celery, horseradish, parsnips, radishes, rutabagas, sugarbeets, turnips
Folpan 80 WDG	folpet	24 hr	cucurbits (vine crops), tomatoes
Fontelis	penthiopyrad	12 hr	beans, brassica crops (see label), carrots, celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, parsnips, peas, peppers, radishes, rutabagas, spinach, Swiss chard, tomatoes, turnips
Fulfill 50WG	pymetrozine	12 hr	celery, parsley, lettuce (head and leaf), endive, potatoes, rhubarb, spinach, Swiss chard
Gavel 75 DF	zoxamide/mancozeb	48 hr	potatoes
Granuflo-T	thiram	24 hr	sweet potatoes
Grapple$_2$	imidacloprid	24 hr	cucurbits (vine crops), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes
Headline EC	pyraclostrobin	12 hr	beans, peas, potatoes, sugarbeets, sweet corn
Imidan 70-WP	phosmet	5 days See label for details on restricted entry interval.	carrots, celery, potatoes
Inspire	difenoconazole	**hand-harvesting, irrigation:** 3 days **scouting:** 24 hr **all other activities:** 12 hr	brassica crops (see label)
		12 hr	cucurbits (vine crops), eggplant, garlic, onions (dry bulb and green), leeks, shallots, peppers, potatoes, sugarbeets, tomatoes
Intrepid	methoxyfenozide	12 hr	beans, brassica crops (see label), celery, parsley, lettuce (head and leaf), endive, peppers, rhubarb, spinach, Swiss chard, sweet corn, tomatoes
Kanemite 15SC	acequinocyl	12 hr	eggplant
Kasumin 2L	kasugamycin	12 hr	peppers, tomatoes
Kocide 2000	copper hydroxide	**field applications:** 48 hr **greenhouse transplants:** 24 hr	beans, peppers (field and transplants), potatoes, tomatoes (field and transplants)
Lance WDG	boscalid	12 hr	beans, peas

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Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Lannate Toss-N-Go (TNG)	methomyl	12 hr	beans, Brussels sprouts, peas, tomatoes
		hand-pruning, hand-harvesting: 2 days **all other activities:** 12 hr	broccoli, cabbage, cauliflower
		hand-pruning, hand-harvesting, thinning: 1 day **all other activities:** 12 hr	lettuce
		hand-detasselling: 18 days **all other activities:** 12 hr	sweet corn
Lorsban 15G	chlorpyrifos	1 day	broccoli, Brussels sprouts, cabbage, onions (bulb and pickling), shallots, rutabagas
		10 days	cauliflower
Lorsban 4E	chlorpyrifos	1 day	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber, garlic, onions (bulb and pickling), onions (green), pepper (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Lorsban 50W	chlorpyrifos	24 hr	cabbage
Lorsban NT	chlorpyrifos	1 day	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber garlic, onions (bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Luna Tranquility	fluopyram/pyrimethanil	12 hr	potatoes
Maestro 80DF	captan	48 hr	cucumber, tomatoes, vegetable transplants in greenhouse (crucifers, celery, eggplant, peppers, tomatoes)
Manzate Pro-Stick	mancozeb	24 hr	carrots, celery, cucumbers, pumpkins, melons, squash, cantaloupe, onions (dry bulb), potatoes, sugarbeets, tomatoes
Matador 120EC	lambda-cyhalothrin	24 hr	asparagus, beans, carrots, celery, cucurbits (vine crops), garlic, lettuce (head and leaf), onions (dry bulb), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes
		for scouting: 4 days **hand-pruning, topping, irrigation, thinning, tying:** 6 days **all other activities:** 24 hr	brassica crops (see label)
		hand-harvest, thinning: 10 days **all other activities:** 24 hr	onions (green)
Mettle 125 ME	tetraconazole	**irrigation:** 3 days **all other activities:** 12 hr	sugarbeets
Microscopic Sulphur	sulphur	24 hr	rutabagas
Microthiol Disperss	sulphur	24 hr	peas, sugarbeets
MilStop	potassium bicarbonate	4 hr	cucurbits (vine crops), herbs, peppers

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[1] Workers must wear required personal protective equipment in the field for a certain period of time following applications, even after the REI. See label for information.

Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Movento 240 SC	spirotetramat	12 hr	brassica crops (see label), celery, cucurbits (vine crops), eggplant, garlic, parsley, chives, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, potatoes, rhubarb, spinach, Swiss chard, sweet potatoes, sweet corn, tomatoes
Nova	myclobutanil	Re-entry permitted once spray deposit has dried.	asparagus
		12 hr	cucurbits (vine crops)
Nufos 4E	chlorpyrifos	1 day	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumber, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sweet corn
		10 days	cauliflower
Oberon Flowable	spiromesifen	12 hr	cucurbits (vine crops), eggplant, peppers, sweet potatoes, tomatoes
Orthene 75% Soluable Powder (SP)	acephate	12 hr	Brussels sprouts, cabbage, cauliflower, tomatoes
		1 day	celery[1], lettuce (head)[1], peppers, potatoes[1]
		5 days	sweet corn[1]
Parasol Flowable	copper hydroxide	48 hr	potatoes
Parasol WG	copper hydroxide	48 hr	beans, cucumbers, peppers, sugarbeets, tomatoes
Penncozeb 75DF Raincoat	mancozeb	24 hr	carrots, celery, cucurbits (vine crops), onions (dry bulb), potatoes, tomatoes
Perm-UP	permethrin	12 hr	asparagus, beans (snap), beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips
Phostrol	mono- and dibasic sodium, potassium and ammonium phosphites	12 hr	brassica crops (see label), cucurbits (vine crops), lettuce (head and leaf), endive, radicchio, potatoes, tomatoes
Pic Plus	chloropicrin	See label for re-entry information.	root and tuber vegetables — CG1 (beets (table), carrots, horseradish, parsnips, radishes, rutabagas, sugarbeets, sweet potatoes, turnips), peppers, potatoes, tomatoes
Pounce 384EC	permethrin	Re-entry permitted once spray deposit has dried.	asparagus, beans (snap), beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, pak choy, carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips
Presidio	fluopicolide	12 hr	cucurbits (vine crops), lettuce (head and leaf), potatoes, rutabagas, spinach, tomatoes
		hand-pruning, irrigation: 1 day **all other activities:** 12 hr	brassica crops (see label)
Prestop	*Gliocladium catenulatum*	4 hr	greenhouse herb transplants (oregano, basil, parsley, thyme, dill)

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Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Pristine WG	boscalid/pyraclostrobin	4 days	brassica crops (see label)
		hand-harvesting: 3 days Re-entry permitted for all other activities once spray deposit has dried.	carrots
		hand-thinning, hand-harvesting: 9 days **all other activities:** 24 hr	celery, spinach
		hand-harvesting, thinning, pruning and turning: 3 days **all other activities:** 12 hr	cucurbits
		thinning: 3 days Re-entry permitted for all other activities once spray deposit has dried.	garlic, chives, onions (dry bulb and green), leeks, shallots
Proline 480 SC	prothioconazole	**hand line irrigation:** 3 days **all other activities:** 24 hr	cucurbits (vine crops)
		24 hr	sugarbeets
Pyrifos 15G	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, onions (dry bulb and pickling), rutabagas, sweet corn
		10 days	cauliflower
Pyrinex 480 EC	chlorpyrifos	1 day	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, carrots, celery, cucumbers, garlic, onions (dry bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Quadris Flowable	azoxystrobin	12 hr	asparagus, beets (table), cabbage, carrots, celery, horseradish, potatoes, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips
Quadris Top	azoxystrobin/ difenoconazole	12 hr	carrots, cucurbits (vine crops), eggplant, garlic, chives, onions (dry bulb and green), leeks, shallots, peppers, potatoes, sugarbeets, tomatoes
		hand-harvesting: 3 days **scouting:** 1 day **all other activities:** 12 hr	brassica crops (see label)
Quash Fungicide	metconazole	**hand set irrigation:** 7 days **roguing:** 2 days **scouting:** 12 hr	potatoes
Quilt	azoxystrobin/ propiconazole	12 hr	mint, peas
		hand harvesting and detasseling: 1 day	sweet corn
Quintec	quinoxyfen	12 hr	melons, pumpkins, winter squash, lettuce (head and leaf)
Rampart	mono- and dipotassium salts of phosphorous acid	4 hr	potatoes

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Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Ranman 400SC	cyazofamid	12 hr	beans, brassica crops (see label), carrots, cucurbits (vine crops), basil, lettuce (head and leaf), potatoes, spinach, tomatoes, transplants (brassica crops, cucumber, lettuce, peppers, tomatoes)
Reason 500SC	fenamidone	2 days	brassica crops (see label)
		Re-entry permitted once spray deposit has dried.	cucurbits (vine crops), onions (dry bulb and green), leeks, shallots, potatoes
		12 hr	tomatoes
Regalia Maxx	extract of *Reynoutria sachalinensis*	Re-entry permitted once spray deposit has dried.	cucurbits (vine crops), tomatoes
Revus	mandipropamid	12 hr	brassica crops (see label), cucurbits (vine crops), garlic, lettuce (head and leaf), onions (dry bulb), shallots, pepper (transplants), potatoes, spinach, tomatoes
Ridomil Gold 1G	metalaxyl-M and S-isomer	12 hr	carrots, lettuce (head)
Ridomil Gold 480SL	metalaxyl-M and S	12 hr	beans (snap), cucumbers, radish, spinach, potatoes
Ridomil Gold MZ 68WG	metalaxyl-M and S/ mancozeb	24 hr	lettuce (head), onions, potatoes
Rimon 10 EC	novaluron	12 hr	beans (snap), brassica crops (see label), peppers, potatoes
Rootshield Granules	*Trichoderma harzianum*	**greenhouse applications:** 4 hr	cucumbers, peppers, tomatoes
Rootshield HC	*Trichoderma harzianum*	**greenhouse applications:** 4 hr	beans, lettuce, peas, peppers, tomatoes
Rovral	iprodione	12 hr	beans (snap), cabbage, cauliflower, carrots (imported seed), garlic, lettuce, onions (dry bulb), leeks
Scala SC	pyrimethanil	**hand-thinning:** 24 hr **all other activities:** 12 hr	garlic, chives, onions (bulb and green), leeks, shallots,
		12 hr	potatoes, tomatoes
Silencer 120 EC	lambda-cyhalothrin	24 hr	asparagus, beans, carrots, garlic, lettuce (head and leaf), onions (dry bulb), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes
		hand-pruning, topping, irrigation, thinning, tying: 6 days **scouting:** 4 days **all other activities:** 24 hr	brassica crops (see label)
		hand-harvesting, thinning: 10 days **all other activities:** 24 hr	onions (green)

[1] Workers must wear required personal protective equipment in the field for a certain period of time following applications, even after the REI. See label for information.

Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Success	spinosad	Re-entry permitted once spray deposit has dried.	asparagus, beans (snap), celery, eggplant, garlic, parsley, chives, horseradish, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, peppers, radishes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnips
		hand-harvesting, irrigating, pruning, topping, thinning, tying: 3 days Re-entry permitted for all other activities once spray deposit has dried.	brassica crops (see label)
		12 hr	potatoes
		hand-harvesting, detasselling: 7 days	sweet corn
Superior 70 Oil	mineral oil	12 hr	potatoes, rutabagas
Supra Captan 80 WDG	captan	48 hr	cucumbers, tomatoes, vegetable transplants in greenhouse (eggplant, peppers, tomatoes)
Switch 62.5 WG	cyprodinil/fludioxonil	12 hr	beets (table), beans, cabbage, mustard greens, carrots, horseradish, onions (dry bulb and green), parsnips, peppers, radishes, rutabagas, tomatoes, turnips
		harvesting: 3 days	spinach
Tanos 50 DF	famoxadone/ cymoxanil	24 hr	potatoes
		12 hr	tomatoes
Tattoo C	propamocarb/ chlorothalonil	48 hr **short-term tasks with personal protective equipment:** 4 hr	potatoes, cucurbits (vine crops)
Thionex 50W WSP	endosulfan	4 days	celery, cucumber, melon, lettuce (head)
		9 days	eggplant, pepper
		hand-weeding, pruning, hand-thinning: 12 days **all other activities:** 10 days	squash, pumpkin
		5 days	potatoes
Thionex EC	endosulfan	4 days	eggplant, peppers, tomatoes
		irrigation, scouting: 10 days **all other activities:** 48 hr	sugarbeet
Tilt 250E	propiconazole	**hand-harvesting, detasselling:** 1 day **all other activities:** 12 hr	sweet corn
Titan	clothianidin	12 hr	potatoes
Tivano	citric and lactic acid	Re-entry permitted once spray deposit has dried.	pumpkins, squash, tomatoes
Topas	propiconazole	12 hr	asparagus, rutabagas
Torrent 400SC	cyazofamid	12 hr	beans, brassica crops (see label), carrots, cucurbits (vine crops), basil, lettuce (head and leaf), potatoes, spinach, tomatoes, greenhouse transplants (tomatoes, peppers, cucumber, brassicas and lettuce)
UP-Cyde 2.5 EC	cypermethrin	12 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips

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Table 4–3. Re-Entry or Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hr. See *Restricted Entry Intervals*, on page 21, for more information.

Trade Name(s)	Active Ingredient	Re-Entry or Restricted Entry Interval	Crops
Verimark	cyantraniliprole	12 hr	brassica crops (see label), potatoes
Vertisan	penthiopyrad	12 hr	potatoes, sugarbeets, sweet potatoes
		hand-detasselling: 3 days **all other activities:** 12 hr	sweet corn
Voliam Xpress	lambda-cyhalothrin/ chlorantraniliprole	24 hr	sweet corn
Vydate L	oxamyl	3 days	potatoes
Warhawk 480 EC	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumbers, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Zampro	ametoctradin/ dimethomorph	**hand-harvesting, irrigation:** 6 days **scouting:** 4 days **all other activities:** 12 hr	brassica crops (see label)
		hand-harvesting, pruning, thinning: 1 day **all other activities:** 12 hr	cucurbits (vine crops)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, thinning: 1 day **all other activities:** 12 hr	garlic, onions (dry bulb and green), leeks, shallots
		hand-harvesting: 1 day **all other activities:** 12 hr	lettuce (head and leaf), endive, radicchio

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Table 4–4. Pesticides Used in Vegetable Crops That Affect Cholinesterase Levels in Blood

Product Name	Common Name(s)
acephate	Orthene 75 SP
carbaryl	Sevin XLR
chlorpyrifos	Lorsban 15G, Lorsban 50 W, Lorsban 4E, Lorsban NT, Nufos 4E, Pyrifos 15 G, Pyrinex 480 EC, Warhawk 480 EC
diazinon	Diazinon 50 WSP, Diazinon 500 E, Agrox B-2, Agrox CD, DCT
dimethoate	Cygon 480, Lagon 480
malathion	Malathion 25W, Malathion 85E
methomyl	Lannate Toss-N-Go (TNG)
naled	Dibrom
oxamyl	Vydate L
phorate	Thimet 15-G
phosmet	Imidan 70-WP

5. Appendices

Appendix A. Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs Vegetable Crop Advisory Staff

A complete list of OMAF and MRA advisory staff is available on the OMAF website at www.ontario.ca/crops.

Specialty	**Staff**	**Tel/Fax**	**E-mail**
Application Technology Specialist	Jason Deveau	Tel 519-426-8934 Fax 519-428-1142	jason.deveau@ontario.ca
Crop Protection Program Lead	Denise Beaton	Tel 519-826-6594 Fax 519-826-4964	denise.beaton@ontario.ca
Entomologist — Horticulture Program Lead	Hannah Fraser	Tel 905-562-1674 Fax 905-562-5933	hannah.fraser@ontario.ca
IPM Systems Specialist	Margaret Appleby	Tel 613-475-5850 Fax 613-475-3835	margaret.appleby@ontario.ca
IPM Specialist, Specialty Crops	Melanie Filotas	Tel 519-426-4434 Fax 519-428-1142	melanie.filotas@ontario.ca
Minor Use Coordinator	Jim Chaput	Tel 519-826-3539 Fax 519-826-4964	jim.chaput@ontario.ca
New Crop Development Specialist	Evan Elford	Tel 519-426-4509 Fax 519-428-1143	evan.elford@ontario.ca
Nutrient Management Horticulture Crops Program Lead	Deanna Németh	Tel 905-562-1170 Fax 905-562-5933	deanna.nemeth@ontario.ca
Nutrition — Horticulture Program Lead	Christoph Kessel	Tel 519-824-4120, ext. 52480 Fax 519-824-5730	christoph.kessel@ontario.ca
Pathologist — Horticulture Program Lead	Michael Celetti	Tel 519-824-4120, ext. 58910 Fax 519-767-0755	michael.celetti@ontario.ca
Potato Specialist	Eugenia Banks	Tel 519-826-3678 Fax 519-826-4964	eugenia.banks@ontario.ca
Soil Management Specialist — Hort Crops	Anne Verhallen	Tel 519-674-1614 Fax 519-674-1564	anne.verhallen@ontario.ca
Vegetable Crops Specialist	Marion Paibomesai	Tel 519-826-4963 Fax 519-826-4964	marion.paibomesai@ontario.ca
Vegetable Crops Specialist	Janice LeBoeuf	Tel 519-674-1699 Fax 519-674-1564	janice.leboeuf@ontario.ca
Vegetable Crops Specialist	Elaine Roddy	Tel 519-674-1616 Fax 519-674-1564	elaine.roddy@ontario.ca
Weed Management Program Lead — Horticulture	Kristen Obeid	Tel 519-738-1232 Fax 519-738-4564	kristen.obeid@ontario.ca

Agricultural Information Contact Centre

Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Rd. W.
Guelph, ON N1G 4Y2

Tel: 1-877-424-1300
Fax: 519-826-3442
E-mail: ag.info.omaf@ontario.ca

Appendix B. Ontario Ministry of Environment — Regional Contact Information

Region/County	Address	Telephone/fax
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge St., 8th Floor Toronto, ON M2M 4J1	Tel 416-326-6700 Toll-free 1-800-810-8048 Fax 416-325-6345
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King St. W., 12th Floor Hamilton, ON L8P 4Y7	Tel 905-521-7640 Toll-free 1-800-668-4557 Fax 905-521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp. of South Algonquin)	1259 Gardiners Rd., Unit 3 PO Box 22032 Kingston, ON K7M 8S5	Tel 613-549-4000 Toll-free 1-800-267-0974 Fax 613-548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Rd. London, ON N6E 1L3	Tel 519-873-5000 Toll-free 1-800-265-7672 Fax 519-873-5020
Northern Region (East) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch St., Ste. 1201 Sudbury, ON P3E 5P9	Tel 705-564-3237 Toll-free 1-800-890-8516 Fax 705-564-4180
Northern Region (West) Algoma (West), Cochrane, Kenora, Rainy River, Timmins, Thunder Bay	435 James St. S., Ste. 331 Thunder Bay, ON P7E 6S7	Tel 807-475-1205 Toll-free 1-800-875-7772 Fax 807-475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Ave. W., 7th Floor Toronto, ON M4V 1L5	Tel 416-327-5519 Fax 416-327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Ave. W., 12A Floor Toronto, ON M4V 1L5	Tel 416-314-8001 Toll-free 1-800-461-6290 Fax 416-314-8452

Appendix C. Accredited Soil-Testing Laboratories in Ontario

The following labs are accredited to perform soil tests for pH, buffer pH, P, K, Mg and Nitrate-N on Ontario soils.

Laboratory Name	Address	Telephone/Fax/E-mail	Contact
A & L Canada Laboratories Inc. www.alcanada.com	2136 Jetstream Rd. London, ON N5V 3P5	Tel 519-457-2575 Fax 519-457-2664 E-mail alcanadalabs@alcanada.com	Greg Patterson Ian McLachlin
Activation Laboratories www.actlabsag.com/	9-1480 Sandhill Dr. Ancaster, ON L9G 4V5	Tel 289-204-0515, ext. 102/104 Fax 289-204-0514 E-mail Laboratory@ActLabsAg.com	Rob Deakin Dr. Steve Jenkins
Agri-Food Laboratories www.agtest.com	503 Imperial Rd. Unit #1 Guelph, ON N1H 6T9	Tel 519-837-1600 1-800-265-7175 Fax 519-837-1242 E-mail ca.agri.guelph.lab@sgs.com	Jack Legg Papken Bedirian
Brookside Laboratories, Inc. www.blinc.com	200 White Mountain Dr. New Bremen, OH 45869	Tel 419-753-2448 Fax 419-753-2949 E-mail mflock@blinc.com	Mark Flock
Exova Accutest Laboratory Exova Canada Inc. www.exova.com	8-146 Colonnade Rd. Ottawa, ON K2E 7Y1	Tel 613-727-5692, ext. 317 Fax 613-727-5222 E-mail lorna.wilson@exova.com	Lorna Wilson
FoReST Laboratory lucas.lakeheadu.ca/forest/	955 Oliver Rd. BB1005D Thunder Bay, ON P7B 5E1	Tel 807-343-8639 Fax 807-343-8116 E-mail soilslab@lakeheadu.ca	Breanne Neufield Joel Symonds
University of Guelph Laboratory Services www.guelphlabservices.com	University of Guelph P.O. Box 3650 95 Stone Rd. W. Guelph, ON N1H 8J7	Tel 519-767-6299 Fax 519-767-6240 E-mail aflinfo@uoguelph.ca	Nick Schrier
Stratford Agri Analysis www.stratfordagri.ca/	1131 Erie St. Box 760 Stratford, ON N5A 6W1	Tel 519-273-4411 1-800-323-9089 Fax 519-273-2163 E-mail info@stratfordagri.ca	Keith Lemp Mark Aikman

There is no official accreditation in Ontario for tissue analysis, but all the accredited soil-testing labs are monitored for proficiency on tissue analyses.

Appendix D. Production Insurance

Production Insurance (PI) covers production losses and yield reductions caused by insured perils. This includes adverse weather, disease, wildlife and insect infestations. Depending on the plan, coverage is available on a total-yield, dollar-value or acreage-loss basis. Producers can choose the type and level of coverage that best meets their needs. When enrolled in PI, producers are guaranteed a level of production, based on their yield history and their chosen coverage level. Claims are paid when an insured peril causes a yield to fall below the guaranteed production.

In Ontario, Agricorp administers PI on behalf of the Government of Ontario and Agriculture and Agri-Food Canada. More than 16,000 producers and 2 million hectares (5 million acres) of Ontario farmland are insured each year.

Production Insurance is part of programming available under the federal-provincial-territorial initiative Growing Forward 2. In most plans, producers pay 40% of the total premium cost and none of the administration cost. Together, the federal and provincial governments contribute the other 60%. Administrative costs are fully funded by both levels of government.

PI is available to all Ontario farmers, landlords and sharecroppers who grow an eligible crop. Coverage is available on approximately 90 commercially grown crops in Ontario in the following sectors:

- forage
- fresh vegetables
- fruit
- grains and oilseeds
- processing vegetables
- specialty crops

For more information, call Agricorp weekdays, 7 AM to 5 PM, at 1-888-247-4999 or visit www.agricorp.com.

Agricorp
1 Stone Rd. W.
Box 3660, Stn. Central
Guelph, ON N1H 8M4

Tel: 1-888-247-4999
TTY: 1-877-275-1380
Fax: 519-826-4118
E-mail: contact@agricorp.com
www.agricorp.com

ONTARIO CROPS COVERED BY PRODUCTION INSURANCE (AS OF MAY 28, 2013)

General Crops

- buckwheat
- canola
- coloured beans (black, cranberry, kidney, Japanese/other)
- corn (conventional, organic options)
- flax
- forage (excess and insufficient options)
- mustard
- new forage seeding (premium and standard)
- peanuts
- popping corn
- rye
- soybeans (conventional, tofu, natto and organic options available)
- spring grain
- seed corn
- sorghum
- spring wheat
- sugar beets
- sunflower
- triticale
- white beans
- winter spelt, organic
- winter wheat (soft white, hard white, soft red, hard red, organic options)

Specialty Crops

- industrial hemp
- honey
- tobacco (black, burley, flue-cured)

Fruit Crops

- apples and apple trees
- cherries (sweet, sour)
- grapes and grape vines
- peaches/nectarines
- pears
- plums
- strawberries

Vegetable Crops — Average Farm Yield or Total Production

- asparagus
- broccoli
- green beans and wax beans (processing)
- butternut squash (processing)
- cabbages
- carrots (fresh)
- carrots (processing)
- cauliflower
- celery
- cucumbers (processing)
- lettuce
- lima beans (processing)
- onions (seed, set, spanish, yellow)
- parsnips
- peas (processing)
- peppers (banana, bell)
- potatoes (fresh)
- potatoes (processing)
- red beets (processing)
- rutabagas
- sweet corn (fresh)
- sweet corn (processing)
- tomatoes (fresh)
- tomatoes (processing)

Fresh Market Vegetables — Acreage Loss

Root Vegetables

- carrots
- celeriac
- French shallots
- garlic
- green onions
- leeks
- parsnips
- radishes
- red beets
- rutabagas
- Spanish onions
- sweet potatoes
- turnips
- yellow onions

Leafy Vegetables

- broccoli
- Brussels sprouts
- cauliflower
- celery
- Chinese cabbage
- kale
- lettuce
- mesclun
- spinach
- summer cabbage
- winter cabbage

Fruit Vegetables

- cucumbers
- eggplant
- melons
- bell and specialty peppers
- pumpkins
- squash
- tomatoes
- watermelon
- zucchini

Other Vegetables

- broad beans
- green and wax beans
- green peas
- sweet corn

Appendix E. Other Contacts

AGRICULTURE & AGRI-FOOD CANADA RESEARCH CENTRES

www.agr.gc.ca/index_e.php

Eastern Cereals and Oilseeds Research Centre
960 Carling Ave.
Ottawa, K1A 0C6
Tel 613-759-1858

Greenhouse and Processing Crops Centre
2585 County Road 20
Harrow, N0R 1G0
Tel 519-738-2251

Southern Crop Protection and Food Research Centre
1391 Sandford St.
London, N5V 4T3
Tel 519-457-1470

Vineland Research Farm
4902 Victoria Ave. N.
Vineland, L0R 2E0
Tel 905-562-4113

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca

Belleville
345 College St. E.
Belleville, K8N 5S7
Tel 613-969-3333

Brantford
625 Park Rd. N., Ste. 6
Brantford, N3T 5P9
Tel 519-753-3478

Hamilton
709 Main St. W., Ste. 101
Hamilton, L8S 1A2
Tel 905-572-2201

London
19-100 Commissioners Rd. E.
London, N5Z 4R3
Tel 519-691-1300

St. Catharines
395 Ontario St., Box 19
St. Catharines, L2N 7N6
Tel 905-937-8232

Ottawa District
38 Auriga Dr., Unit 8
Ottawa, K2E 8A5
Tel 613-274-7374, ext. 221

Toronto
1124 Finch Ave. W., Unit 2
Downsview, M3J 2E2
Tel 416-665-5055

UNIVERSITY OF GUELPH

Main Campus
Guelph, N1G 2W1
Tel 519-824-4120
www.uoguelph.ca

Alfred Campus
Alfred, K0B 1A0
Tel 613-679-2218
Fax 613-679-2423
www.alfredc.uoguelph.ca

Kemptville Campus
Kemptville, K0G 1J0
Tel 613-258-8336
Fax 613-258-8384
www.kemptvillec.uoguelph.ca

Ridgetown Campus
Ridgetown, N0P 2C0
Tel 519-674-1500
www.ridgetownc.uoguelph.ca

Department of Plant Agriculture
www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph
50 Stone Rd. W.
Guelph, N1G 2Wl
Tel 519-824-4120, ext. 56083
Fax 519-763-8933

Department of Plant Agriculture, Simcoe
1283 Blueline Rd., Box 587
Simcoe, N3Y 4N5
Tel 519-426-7127
Fax 519-426-1225

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Ave. N.
Vineland Station, L0R 2E0
Tel 905-562-4141
Fax 905-562-3413

Lab Services Division
P.O. Box 3650, 95 Stone Rd. W.
Guelph, N1H 8J7
Tel 519-767-6299
www.uoguelph.ca/labserv/

Trace Organics and Pesticides
Tel 519-767-6485

Pest Diagnostic Clinic
Tel 519-767-6256

VINELAND RESEARCH AND INNOVATION CENTRE
4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel 905-562-0320
Fax 905-562-0084
www.vinelandresearch.com

Appendix F. Diagnostic Services

Samples for disease diagnosis, insect or weed identification, nematode counts and Verticillium testing can be sent to:

Pest Diagnostic Clinic

Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph Ontario, N1H 8J7
Tel 519-767-6299
Fax 519-767-6240
E-mail aflinfo@uoguelph.ca
Website www.guelphlabservices.com

Payment must accompany samples at the time of submission. Submission forms are available at www.guelphlabservices.com/AFL/submit_samples.aspx.

How to Sample for Nematodes

Soil

When to Sample

Soil and root samples can be taken at any time of the year that the soil is not frozen. In Ontario, nematode soil population levels are generally at their highest in May and June and again in September and October.

How to Sample Soil

Use a soil sampling tube, trowel or narrow-bladed shovel to take samples. Sample soil to a depth of 20–25 cm. If the soil is bare, remove the top 2 cm prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well. Then take a sample of 0.5–1 L from this. No one sample should represent more than 2.5 ha. Mix subsamples in a clean pail or plastic bag.

Sampling Pattern

If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees, this is the drip line).

Number of Subsamples

Based on the total area sampled:

500 m^2	10 subsamples
500 m^2–0.5 ha	25 subsamples
0.5 ha–2.5 ha	50 subsamples

Roots

From small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g, dig fresh weight from the feeder root zone and submit.

Problem Areas

Take soil and root samples from the margins of the problem area where the plants are still living. If possible, also take samples from healthy areas in the same field. If possible, take both soil and root samples from problem and healthy areas in the same field.

Sample Handling

Soil Samples

Place in plastic bags as soon as possible after collecting.

Root Samples

Place in plastic bags and cover with moist soil from the sample area.

Storage

Store samples at 5°C–10°C and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample Submission Forms

Forms can be obtained from your local Ontario Ministry of Agriculture and Food office. Carefully fill in all of the categories on the form. In the space provided, draw the most obvious symptom and the pattern of the disease in the field. It is important to include the cropping history of the area for the past 3 years and this year's pesticide use records.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system, or several plants showing a range of symptoms. If symptoms are general, collect the sample from an area where they are of intermediate severity. Completely dead material is usually inadequate for diagnosis.

With plant specimens submitted for identification, include at least a 20–25-cm sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to avoid drying out and contamination of the leaves by soil. Do NOT add moisture, as this encourages decay in transit. Cushion specimens and pack in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery

Deliver to the Pest Diagnostic Clinic as soon as possible by first class mail or by courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting Samples

Place dead, hard-bodied insects in vials or boxes and cushion with tissues or cotton. Place soft-bodied insects and caterpillars in vials containing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plant "food" to support them during transit. Be sure to write "live" on the outside of the container.

Appendix G. The Metric System and Abbreviations

Metric units

Linear measures (length)

10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)

Square measures (area)

100 m × 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)

Cubic measures (volume)

Dry measure

1,000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid measure

1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)

Weight-volume equivalents (for water)

(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)

Weight measures

1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)

Dry–liquid equivalents

1 cm^3 = 1 mL
1 m^3 = 1,000 L

Metric conversions

5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 fl. oz.

Handy metric conversion factor (approximate)

litres per hectare × 0.4 = litres per acre

kilograms per hectare × 0.4 = kilograms per acre

Application rate conversions

Metric to Imperial or U.S. (approximate)

litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. gallons per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.015 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre

Imperial or U.S. to metric (approximate)

Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)

Dry weight conversions (approximate)

Metric		**Imperial**
grams or kilograms/hectare		**ounces or pounds/acre**
100 g/ha	=	1½ oz/acre
200 g/ha	=	3 oz/acre
300 g/ha	=	4¼ oz/acre
500 g/ha	=	7 oz/acre
700 g/ha	=	10 oz/acre
1.10 kg/ha	=	1 lb/acre
1.50 kg/ha	=	1¼ lb/acre
2.00 kg/ha	=	1¾ lb/acre
2.50 kg/ha	=	2¼ lb/acre
3.25 kg/ha	=	3 lb/acre
4.00 kg/ha	=	3½ lb/acre
5.00 kg/ha	=	4½ lb/acre
6.00 kg/ha	=	5¼ lb/acre
7.50 kg/ha	=	6¾ lb/acre
9.00 kg/ha	=	8 lb/acre
11.00 kg/ha	=	10 lb/acre
13.00 kg/ha	=	11½ lb/acre
15.00 kg/ha	=	13½ lb/acre

Conversion tables – metric to imperial (approximate)

Length

1 millimetre (mm) = 0.04 inches
1 centimetre (cm) = 0.40 inches
1 metre (m) = 39.40 inches
1 metre (m) = 3.28 feet
1 metre (m) = 1.09 yards
1 kilometre (km) = 0.62 miles

Area

1 square centimetre (cm^2) = 0.16 square inches
1 square metre (m^2) = 10.77 square feet
1 square metre (m^2) = 1.20 square yards
1 square kilometre (km^2) = 0.39 square miles
1 hectare (ha) = 107,636 square feet
1 hectare (ha) = 2.5 acres

Volume (dry)

1 cubic centimetre (cm^3) = 0.061 cubic inches
1 cubic metre (m^3) = 1.31 cubic yards
1 cubic metre (m^3) = 35.31 cubic feet
1,000 cubic metres (m^3) = 0.81 acre-feet
1 hectolitre (hL) = 2.8 bushels

Volume (liquid)

1 millilitre (mL) = 0.035 fluid ounces (Imp.)
1 litre (L) = 1.76 pints (Imp.)
1 litre (L) = 0.88 quarts (Imp.)
1 litre (L) = 0.22 gallons (Imp.)
1 litre (L) = 0.26 gallons (U.S.)

Weight

1 gram (g) = 0.035 ounces
1 kilogram (kg) = 2.21 pounds
1 tonne (t) = 1.10 short tons
1 tonne (t) = 2,205 pounds

Pressure

1 kilopascal (kPa) = 0.15 pounds/in.^{2}

Speed

1 metre per second = 3.28 feet per second
1 metre per second = 2.24 miles per hour
1 kilometre per hour = 0.62 miles per hour

Temperature

°F = (°C × $\frac{9}{5}$) + 32

Conversion tables – imperial to metric (approximate)

Length

1 inch = 2.54 cm
1 foot = 0.30 m
1 yard = 0.91 m
1 mile = 1.61 km

Area

1 square foot = 0.09 m^2
1 square yard = 0.84 m^2
1 acre = 0.40 ha

Volume (dry)

1 cubic yard = 0.76 m^3
1 bushel = 36.37 L

Volume (liquid)

1 fluid ounce (Imp.) = 28.41 mL
1 pint (Imp.) = 0.57 L
1 gallon (Imp.) = 4.55 L
1 gallon (U.S.) = 3.79 L

Weight

1 ounce = 28.35 g
1 pound = 453.6 g
1 ton = 0.91 tonne

Pressure

1 pound per square inch = 6.90 kPa

Temperature

°C = (°F – 32) × $\frac{5}{9}$

Abbreviations

% = per cent
ai = active ingredient
AP = agricultural powder
cm = centimetre
cm^2 = square centimetre
CS = capsule suspension
DF = dry flowable
DG = dispersible granular
DP = dispersible powder
E = emulsifiable
EC = electrical conductivity
e.g. = for example
F = flowable
g = gram
Gr = granules, granular
ha = hectare
kg = kilogram
km/h = kilometres per hour
kPa = kilopascal
L = litre
m = metre
m^2 = square metre
mL = millilitre
mm = millimetre
m/s = metres per second
SC = sprayable concentrate
SP = soluble powder
t = tonne
W = wettable (powder)
WDG = water dispersible granular
WG = wettable granule
WP = wettable powder

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment at **1-800-268-6060.**

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto	1-800-268-9017 1-877-750-2233 (TTY)

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

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- online at www.serviceontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 AM to 5:00 PM ET
  - 416-326-5300
  - 416-326-3408 (TTY)
  - 1-800-668-9938, toll-free across Canada
  - 1-800-368-7095 (TTY), toll-free across Ontario
- in person at ServiceOntario Centres across Ontario

Published by the Ministry of Agriculture and Food
and Ministry of Rural Affairs
©Queen's Printer for Ontario, 2014
Toronto, Canada

ISSN 1927-6427 RV 04-14-2M

www.ontario.ca/crops